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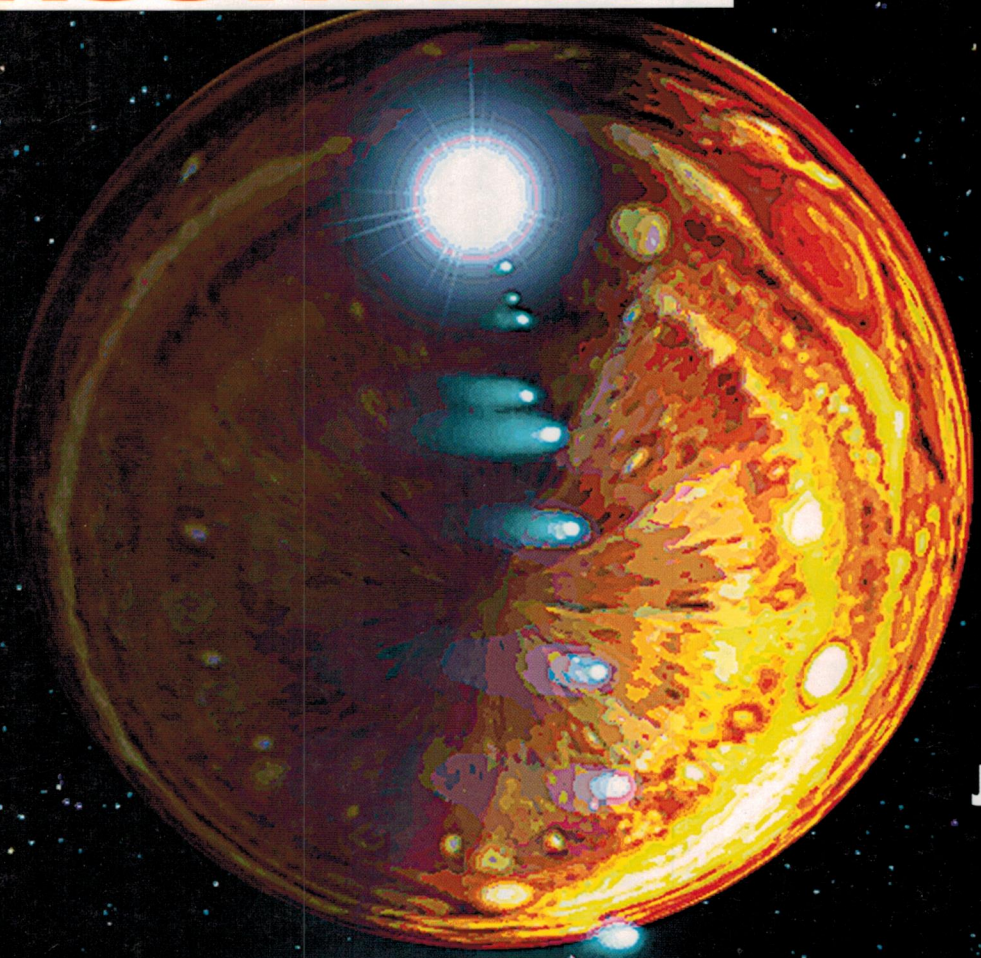

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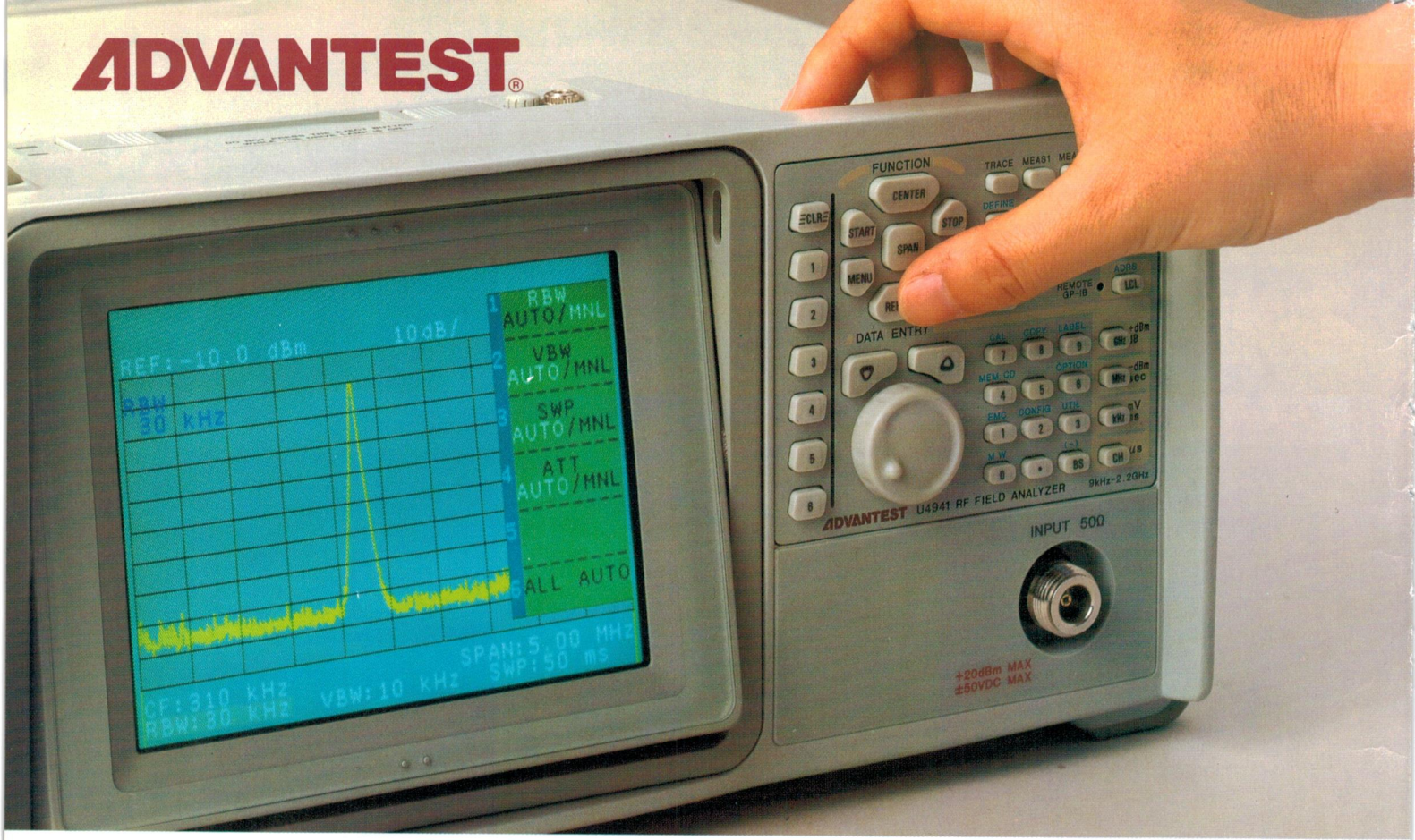

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Electronics AUSTRALIA WITH ETI

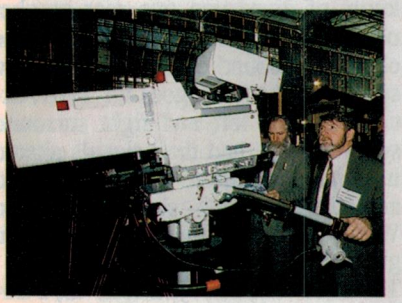
Volume 56, No.10
October 1994

AUSTRALIA'S LARGEST SELLING ELECTRONICS MAGAZINE — ESTABLISHED IN 1922

Listening for the bangs

Radio astronomy pioneer Grote Reber was part of a small expedition to Dennistoun in central Tasmania, to listen for signals from the Shoemaker-Levy 9 comet pieces hitting Jupiter. Tom Moffat tells what happened, starting on page 26...

Convergence in imaging



This year's Society of Motion Picture and Television Engineers Conference and Exhibition, held in Sydney, made it clear that imaging technologies are converging. Barrie Smith reports that film was hardly to be seen, while video and digital imaging technology were well and truly represented. His report starts on page 12.

On the cover

Our main image is an artist's representation of the fragments of comet Shoemaker-Levy 9, approaching the planet Jupiter (courtesy D. Seal). The smaller picture shows Eric Baynes using a spectrum analyser to look for signals around 20.054MHz, at Dennistoun. (Photo: Tom Moffat)

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Phone: (02) 353 0620. Fax: (02) 353 0613
Reader Services: Phone (02) 353 0620
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ELECTRONICS AUSTRALIA is published by Federal Publishing Company a division of Eastern Suburbs Newspapers Partnership, which is owned by General Newspapers Pty Ltd.
A.C.N. 000 117 322,
Double Bay Newspapers Pty Ltd.
A.C.N. 000 237 598 and
Brehmer Fairfax Pty Ltd.
A.C.N. 008 629 767,
180 Bourke Road, Alexandria, NSW 2015.

Printed by Macquarie Print, 51 - 59 Wheelers Lane, Dubbo NSW, 2830, phone (068) 843 444, for Federal Publishing Company.
Distributed by Newsagents Direct Distribution Pty Ltd, 150 Bourke Road, Alexandria, NSW 2015; Phone: (02) 353 9911.
ISSN 1036-0212
*Recommended and maximum Australian retail price.
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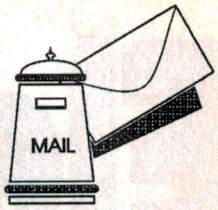
LETTERS TO THE EDITOR



Pay TV? — No!

I have read with interest the comments made recently concerning Pay-TV. Your point about quality is an interesting one, however, I feel that there is an even more fundamental question which no one seems to be asking: What real value is this stuff?

We all know that Australians are gadget mad and that those involved in providing the service will make money, lots of it, out of us — but what do we, the users, get? Having spent the best part of two years living in the land of cable TV, a fair portion of which was spent in hotels with free access to every channel available in the area, I'm afraid that I didn't/don't see the value.

As a simple example, HBO, the primary movie channel, has a rotation list of perhaps 20 movies with recent releases screening anything up to four times a day. Although 'popular' things hang around for longer, most movies appeared to have a lifetime of about two weeks and most of those fell into the "Gee, I guess I'll watch this 'cause there's nothing better on" class.

At the time HBO cost something like $4.50 per week in addition to the $14 - 15 per month basic connection charges; for that amount it was possible to rent two or three first release movies each week! There may have been a few weeks between the release to cable and release to the rental market, but not enough to make any real difference to someone mourning a lost opportunity for a cinema screening.

Even though economics don't follow the nice simple rules we are accustomed to in engineering, one can't help but feel that there's only so much blood in the stone — so a profit in one place must make for some loss in another. Thus it follows that the quality of the free to air channels will drop over time as the cable services outbid them for material. Here, it's all too obvious when we're outside a 'ratings period'. It's rather more difficult to tell the difference over there, and it's not because of the normally high standard!

In short, sod the moguls and the government, support your local video shop instead. It's the best value for money deal in town.

Jonathan R. Wells,
East Malvern, Vic.

THX clarification

I read with interest your review on the Kenwood THX system, and while I enjoyed the article immensely, I wish to point out a few inaccuracies in it.

1. You mention that Lucasfilm THX system was developed for cinema use. While there is a THX standard used in cinemas, it's merely a set of minimum specifications that the theatre must meet both with its audio and video performance, to receive the THX 'seal of approval'. It's NOT a decoding/processing system, unlike the Home THX system now being released.
2. You seem to imply that Lucasfilm THX has six channels; it doesn't. THX processing is done AFTER normal Dolby Pro-logic has decoded the stereo soundtrack from a LaserDisk, Video etc., into FOUR channels (i.e., Left, Centre, Right and Surround). While every Dolby Pro-logic decoder I know of gives you two rear speaker outputs, these are in mono — i.e., one channel of sound coming through two speakers. The same goes for THX, except that the left and right surround speakers have had their signals altered in phase and time to spread the sound around the room — similar to 'Stereo Wide' controls sometimes found on ghetto blasters.
   The sixth 'channel' you refer to, I imagine, is the subwoofer output. While a subwoofer output is part of the Home THX specification, again, every decent Dolby Pro-logic decoder also gives you a subwoofer output, which is merely derived from the existing Left and Right channels. So while you may have six speakers in your THX system, the signal source is only four channel (and that was derived from a two channel source).
3. You mention at the end of the article about THX encoded software. THIS DOES NOT EXIST. You may see the THX logo on some imported NTSC LaserDisks, but again, this refers to the disk having met certain minimum standards for audio and video performance. NOT that the disk has been encoded with a THX soundtrack.

I would like to suggest to Kenwood that

they offer the items separately, because at the moment you HAVE to purchase both. This seems illogical because there are no doubt, many people who would like the processor, but use their current amplifiers; or possibly like me, keep their Pro-logic processors, but use the six channel amp to run multiple surround speakers as is done in normal theatres.

Simon Ulrich,
Ferntree Gully, Vic.

Compact logic probe

I have checked and find that the compact logic probe article published in Circuit & Design Ideas in May 1994, infringes my patent, which has been in force for over five years. The patent attorney has informed me that it is an offence to manufacture even one such item. I have no intention of taking Chris Reinback to court over this infringement, in fact I congratulate him on his ingenuity. Despite that, I feel that I should bring the matter of patent infringement to your notice and to the notice of anyone intending to use his design.

My invention is the Beagle Polarity Probe which has won several awards and was featured in April 1993 *Motor*. His invention is electronically more complicated and probably more difficult to manufacture. It may also be more expensive.

I doubt his claim that it will work successfully on 3V. Ohms law shows that with 3V applied to the circuit the 1500 ohms (disregarding any other losses in the circuit) would limit the current to only 2mA. The LEDs would light on this current, but they would be so dim as to be fairly useless. I have set up 3V on my bench to try it out. It does light but would be difficult to see under any bright ambient light conditions. This is probably not a serious problem as one does not often work on a 3V circuit.

The Beagle Polarity Probe has been on the market since 1988 and is fully patented. It was originally designed for automotive use and therefore designed to operate on six to 24V. It has since been used successfully on 45V.

The Beagle Polarity Probe is available from the inventors and patent holders R.& L. Woodcraft. RRP is $29.50.

Dick Woodcraft,
PO Box 127,
Clayfield, Qld 4011.

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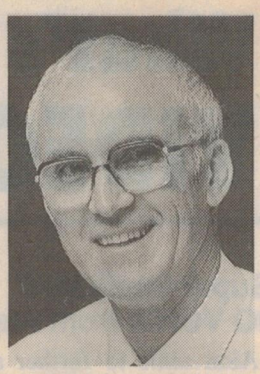
EDITORIAL VIEWPOINT



A glimpse of the information superhighway?

One of the feature stories you'll find in this issue is an account by Tom Moffat of a small expedition he took part in during the recent 'week of excitement', when the fragments of comet Shoemaker-Levy 9 slammed into Jupiter. Tom relates that a hardy trio formed by radio astronomy pioneer Grote Reber, TAFE electronics teacher/astronomer Eric Baynes and himself travelled to the windswept wilds of Dennistoun in central Tasmania, to try picking up HF radio signals from the impact of 'Fragment K'.

(Why Dennistoun? Well, besides being by repute the coldest spot in Australia, according to Grote Reber it's also one of the 'quietest' places in the southern hemisphere, in terms of radio interference. And *he* should know — he built his pioneering 2MHz radio telescope array there, around 1960.)

Now I'm not going to steal Tom's thunder, by talking here about the results of the expedition; you'll have to read his story for that. As usual, it's highly readable and entertaining.

What I personally found most intriguing about the whole Jupiter/Shoemaker-Levy 9 event was the demonstration it gave of two things: (a) the open and altruistic way many of the world's scientists, both 'professional' and 'amateur', are prepared to share their knowledge and data; and (b) the incredible efficiency of today's global data communications network, in allowing this to be done.

Of course most scientists have always been happy to share their knowledge for the common good, so I guess what I'm really saying here is that Shoemaker-Levy simply provided a timely reminder that this spirit is still very much alive and well. Perhaps more important is the demonstration we got of the value of the global data comms network, based on the huge and globally managed Internet.

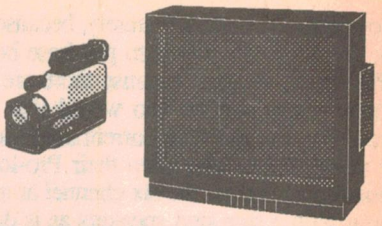
Within hours of the various chunks of the comet crashing into Jupiter, I'm told, images and other information began circulating on the Internet — provided by scientists and astronomers working all around the world. There were images from the Hubble Space Telescope, from observatories in Europe, the USA and Australia, from schools and colleges and enthusiastic individuals. All pooling their information freely, so that everyone could benefit...

To me, this is an excellent demonstration of the potential benefits from the proposed 'information superhighway', and far more impressive than all the talk about 500 TV channels or first-release video movies on demand. Don't you agree?

In fact the best possible form that the information superhighway could take, it seems to me, would be to build upon the foundation provided by the Internet. As long as the ultimate system turns out to be considerably less arcane, and as a result more accessible to we ordinary mortals without a PhD in computer science!

Jim Rowe

What's New in VIDEO and AUDIO



'Super Intelligent' HQ VCR's from Akai

Akai aims to further strengthen its foothold on the VCR market with the introduction of its latest Super Intelligent HQ VCR line-up.

Not to be confused with any competitive picture enhancement type systems, Akai's I-HQ is a proprietary 'auto-tuning' system similar in concept to auto-tuning systems used in high quality audio cassette decks.

Before the development of Intelligent HQ, premium video tapes had not been able to realise their true potential owing to the fact that unlike audio cassette tape decks which have selectors for Normal, High and Metal tapes, conventional VCRs have only a fixed position for normal and S-VHS video tapes.

During recording, the I-HQ 'auto-tuning' circuitry optimises the recording parameters to match the characteristics of the video cassette tape being used. Then during playback the I-HQ circuitry adjusts to the actual condition of the recording, compensating for the level of noise accompanying the video signal and optimising picture detail.

All models in Akai's latest VCR line-up incorporate the benefits of earlier I-HQ technology, with the new Super I-HQ models also including features such as Auto Tape Tuning (for the Hifi Audio VCRs), CACC (Current Auto Chroma Control), and Direct VCO chroma circuit and improved FM equaliser circuitry (VSA-G2100 series), for improved playback picture resolution. Additionally, Super I-HQ VCRs include Akai's intelligent tracking system and new Chroma Process technology.

The line-up of Super I-HQ VCRs commences with Akai's VSG405 'Reviewer' four head, two speed mono VCR, designed for those users who regularly use the VCR for library building. The Reviewer features 13 speed play, eight language on-screen programming, 'flickerless' slow motion, dual mode digital tracking, and front panel A/V line-in jacks. With basic edit functions, the Reviewer is an ideal partner to those who use two speed camcorders.

The VS-G415 'Moviemaker' Super I-HQ four head mono VCR boasts similar features, plus convenience G-code for ease of programming, jog/shuttle, sound dubbing, NTSC playback and Quick Finder features.

Ortofon releases hifi speakers

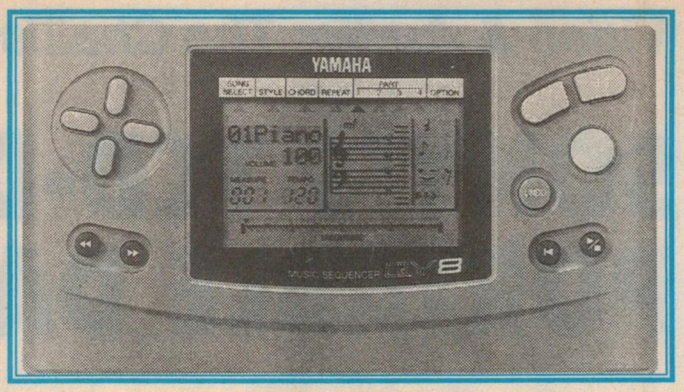
Danish manufacturer Ortofon, internationally famous for its high fidelity pickup cartridges and recording cutter heads for many decades, has released a new range of hifi loudspeaker systems. Called the Concorde series, the new systems have been developed in close cooperation with Danish driver manufacturer Peerless, and use only Danish drivers.

There are three models in the series, designated Concorde 2, Concorde 4 and Concorde 6. All systems are based on two-way bass reflex enclosures incorporating 127mm bass drivers and 25mm dome tweeters. The Concorde 2 is the smallest system, with a single bass driver plus tweeter in each 300 x 225 x 186mm enclosure, and is intended for bookshelf use (70W RMS power handling); the mid-sized Concorde 4 has two bass drivers plus tweeter in each 460 x 225 x 186mm enclosure, and has 90W RMS power handling; and the largest Concorde 6 system again has two bass drivers plus woofer in each 900 x 270 x 186mm enclosure, with provision for bi-wiring.

All three systems have a nominal impedance of four ohms, have gold plated 'banana' terminals and enclosures made from high-quality MDF board, with a black woodgrain finish. The 127mm bass driver unit used has a heavy magnet assembly and a special injection-moulded polypropylene cone.

The RRP for the new Concorde systems is quoted as $599, $999 and $1399 per pair, respectively. Further details are available from Scan Audio, 52 Crown Street, Richmond 3121 or phone (03) 429 2199.

Portable music sequencer from Yamaha



The QY8 Portable Music Sequencer is said to bring a new dimension to the process of music making for the professional amateur and student musician alike. A compact, battery operated unit about the size of a paperback book, the QY8 combines a music sequencer, tone generator and rhythm programme with an intuitive operating system and ergonomic controls.

Resembling a portable electronic game, the QY8 employs similar 'point and shoot' ergonomic controls to enable both beginners and experienced musicians to enter, play and edit compositions quickly and easily. Notes may be recorded directly from the front panel or via an external MIDI keyboard, in real time or step mode. A uniquely 'musical' display shows key signature, time signature, note pitch, duration and more, in standard musical rotation. Pack a QY8 in a pocket, bag or briefcase to compose and record music any time, anywhere — all that is required is a pair of earphones and a little inspiration.

As a practice tool, the QY8 provides instant accompaniment for any instrument, playing chords, bass lines, drums and harmonised melody lines.

Small in size, the unit is big on features. The tone generator delivers 40 instrument voices and 58 drum and percussion sounds, with a maximum of 28 note polyphony for complex pieces. Conforming to General MIDI, the QY8 ensures compatibility with external MIDI equipment and software. The sequencer features eight tracks — four sequence tracks, a rhythm track, bass track and two chord tracks, with a total capacity of around 6400 notes arranged in up to 20 songs. The rhythm programmer features 50 drum patterns, each with six sections of intro, A, B, fill from A to B, fill from B to A, and ending. The QY8 is fitted with a stereo headphone/line output socket, DC input socket, and MIDI in/out terminals. It measures 188 x 34 x 104mm, weighs 370g (without batteries) and is powered by six AA size batteries. An optional mains power adaptor is available.

Yamaha's QY8 Music Sequencer is available from selected music dealers across Australia. For further information, please contact the Yamaha Information Centre toll free on (008) 80 6266.

The VSG705 'Virtuoso' Super I-HQ four head hifi stereo VCR is aimed at those users seeking both outstanding picture and hifi stereo sound quality. This model boasts similar features to the Moviemaker with the added features of stereo sound, the Pro GX4-HF head system for outstanding sound, quality, dual mode digital tracking, plus 'bullet drive' that offers protection of both tape and heads during high speed tape forward/reverse applications.

Finally, the Super I-HQ VSA-G2100 is Akai's flagship four head stereo hifi VCR. This boasts all previously mentioned features, plus 14 multi-play speeds and 16:9 wide screen recording.

The new I-HQ VCR line-up is covered by a 12 months parts and labour warranty. For further information on any of these new I-HQ VCRs contact your nearest Akai dealer or Akai on (02) 763 6300.

Low cost video inverter

Few camcorders are now provided with the positive/negative video polarity switching function which is useful for transferring colour negatives to video, and for creating special effects. Normally the only way to achieve such effects is to use a video processor, costing $300 - 500. However Keene Electronics has produced a low cost dedicated unit, the Viewneg, which is designed to perform this job.

The ViewNeg works with any composite video signal, can be powered from a PP3 battery or external AC adaptor, and has controls for contrast enhancement and black level adjustment.

Further information is available from VideoCam Accessories, PO Box 2000, Strawberry Hills 2012; phone (02) 698 1470 or fax (02) 319 6117.

Kenwood car amps have inbuilt equaliser

Kenwood has high expectations for the two latest additions to its car audio line-up: the KAC-Q74, a four channel amplifier offering 180W + 180W bridged, and the KAC-Q62 stereo amp offering 80W per channel. Both models incorporate a built in five band equaliser.

By incorporating the equaliser directly into the amplifier, Kenwood says it has been able to minimise transmission losses, resulting in outstanding sound quality as well as added savings to the customer.

The inbuilt equaliser also negates the need for a dash mounted unit, creating a less cluttered appearance.

The KAC-Q74 delivers 180W + 180W maximum in bridge mode or can deliver 80 watts into four channels for front and rear sound applications. Both models can also be configured for Kenwood's special tri-mode operation, driving three channels — for example, left and right channels with the third channel driving a subwoofer.

The five band equaliser (one for each channel on KAC-Q74) has a range of +/- 10dB in 12 steps, at 50Hz, 200Hz, 800Hz and 3200Hz and 12.8kHz.

Both the KAC-Q74 ($699) and the KAC-Q62 ($499) are configured with gold plated line jacks and speaker terminal screws.

Front loading CD changer

Harman Kardon has introduced a front loading CD changer, the FL8400, which joins their popular top loading carousel and single play models. The new front loading model incorporates all the design principles that Harman Kardon has consistently deemed critical for high performance playback, including the use of '3D Bit Stream' technology in the digital-to-analog converter.

The FL8400 also features separate power supplies for digital, analog, mechanical and display circuitry, to provide isolation and ensure a cleaner music signal.

Everything is housed in a heavy steel chassis, with a large fluorescent display and a 27-key remote control.

The FL8400 includes a wide range of programming options: many can be selected through the remote control, while others are accessible from the front panel. For example, to record to a cassette, you simply enter the tape's length and favourite tracks, and the FL8400 does the rest. ❖

SONY'S TCD-D7 PORTABLE DAT

This month, Louis Challis had the opportunity to evaluate the latest addition to Sony's stable of DAT (digital audio tape) recorders. Only slightly larger than a Walkman, the TCD-D7 offers the ability to make full CD-quality (48kHz/16 bit sampling) recordings of up to two hours duration, on a tape cassette smaller than a standard analog compact cassette. Alternatively, you can record for well over THREE hours using its 'LP' mode...

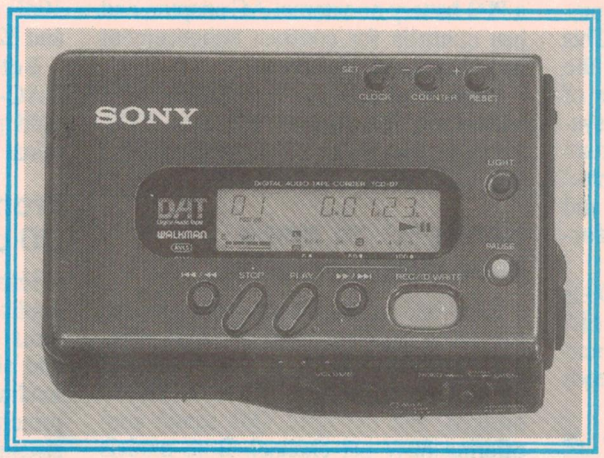
Over the last 25 years, we have all followed the astounding pace of development in the field of tape recording. The two major players have, of course, been Philips and Sony. Both have had some wonderful successes, and both would dearly like to forget their commercial failures.

Whilst Philips developed the ubiquitous compact cassette 25 years ago, and more recently the Digital Compact Cassette (DCC), Sony are equally renowned for their development of Rotary Digital Audio Tape Recorder (R-DAT, or more simply DAT), together with the Mini Disc, which is a comparable but not really similar technology.

Out there in the marketplace, DCC and Mini Disc are slowly making headway against an unusual degree of lethargy, world wide. The reasons behind that lethargy are far too complex to discuss here, but one significant factor is reputed to be associated with the data compression algorithms which both of those systems incorporate. Ultimately, those algorithms result in some perceptible loss of signal quality, and the buyers are less than 'elated' as a consequence.

Now most people who purchase a DAT recorder have done so because DAT recorders offer so much more. A DAT recorder offers an unparalleled performance, which eclipses the performance of any other tape recorder you are ever likely to have owned. The most critical parameters that are enhanced are the frequency response, the dynamic range and most importantly the impressive low distortion at high input levels (below clipping).

I received my first DAT recorder, a Sony DTC-1000ES, in 1986. It was configured for the normal 100V AC Japanese supply voltage and needed a bulky and annoying step-down transformer. The DTC 1000ES's main advantage was that it outperformed all of my conventional Nagras, and even my instrumentation FM recorders. I can remember lugging it over to Western Australia with its step-down transformer, to record noise and vibration in the 'Australind' diesel rail motor, while travelling at speeds in excess of 120kph.



When the first of the battery operated DATs were released, I purchased one, and subsequently another. They provided even greater flexibility than my mains powered DAT, although their frequency responses were not quite as good.

My battery operated DAT recorders are still moderately large, relatively heavy and reliable. My pet gripe, and that of most people, seems to be that battery operated DAT recorders are not 'user friendly'. When used with their standard nickel-cadmium batteries, they invariably 'run out of juice' before the recording task has been completed.

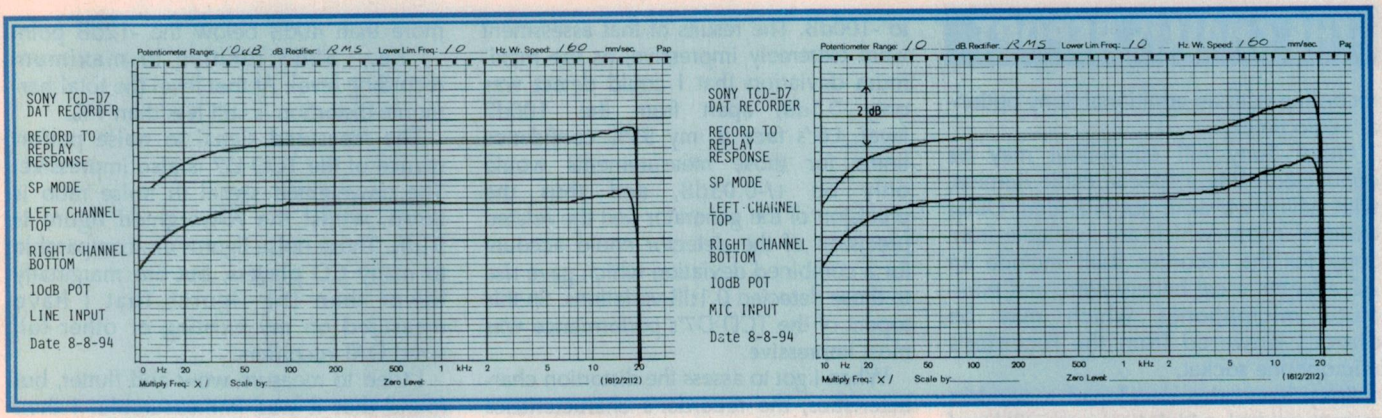
Some three years ago, Sony's sister company AIWA released a very small and exciting miniature DAT recorder. Sadly, relatively few of those recorders made it to Australia. The AIWA portable DAT recorders offered the capability of operating on conventional batteries, and that was an obvious 'desirable attribute' that the Sony design engineers had clearly missed. Its market attraction was however noted, so that when developing the TCD-D7, Sony's research engineers reappraised their battery options.

Although they were developing some exciting new energy efficient metal-halide batteries, they followed the AIWA lead and incorporated a battery pack that accepts standard AA manganese alkaline batteries. This may not be 'state of the art', but believe me — it will prove to be much more practical and 'user friendly' than any rechargeable battery, when the batteries go flat.

The new TCD-D7

When I picked up the Sony TCD-D7, I was immediately impressed by the controls. They are simple, practical and well laid out on the front panel. What I liked best is that you can record in the dark. You can even operate the recorder in your pocket, without even seeing the controls. Whilst that may not seem all that important to you, there are many tape recorder users (and I know quite a few), who wish to record a wide range of subjects or conversations without their recording activities being observed, or even evident to those around them.

To facilitate such functions, the designers have connected the rotary RECORD LEVEL control on the right hand side of the TCD-D7 to a three-position switch. The RECORD LEVEL rotary control only functions when the RECORD MODE is switched to the MANUAL position. Two



These plots show the measured record/replay frequency response characteristics for the Sony TCD-D7 DAT recorder, running in 'standard' (SP) mode. The response from the line inputs is on the left, with those from the mic inputs on the right. The vertical axis has been expanded as indicated, to exaggerate the variations.

other AUTO positions are provided. One meets the requirements of MUSIC (with a long time constant), the other for SPEECH (with a relatively short time constant).

Adjacent are two miniature stereo jacks, one for LINE IN and one for MICROPHONE IN. The microphone socket is coupled to a separate switch, which controls MICROPHONE SENSITIVITY. One switch setting is suitable for low sensitivity microphones (220mV) and the other for high sensitivity microphones (2mV). A separate stereo jack is provided for HEADPHONES, which doubles as the LINE OUTPUT.

A separate switch on the front panel provides the option of having automatic volume limiting settings, so that you may avoid blasting your ears at the highest listening levels. That switch also selects the dual function of LINE OUTPUT.

The other controls on the lower edge of the front panel are a manual switch which controls the tape unwind mechanism, by means of which the lid may be opened to gain access to the DAT tape. As I found, if the batteries are flat you can't activate this control.

Two pushbuttons are provided for increasing or decreasing replay volume on the headphones or LINE OUTPUT. A separate small recessed switch at the lower edge of the panel provides for STANDARD PLAY or LONG PLAY recording modes. In the LONG PLAY mode, tape recording time is effectively doubled, at the expense of bandwidth and to a lesser extent, dynamic range uniformity.

The major and most frequently used controls are located on the front panel below the LCD display. The most important of these is clearly the large red RECORD/ID button, with a regular textured surface so that you can detect it in the dark.

The combination of the conventional RECORD function with the IDENTIFICATION or ID function in one switch is a real plus. This avoids the need to activate a separate function button, as was generally the case with previous Sony DAT recorders.

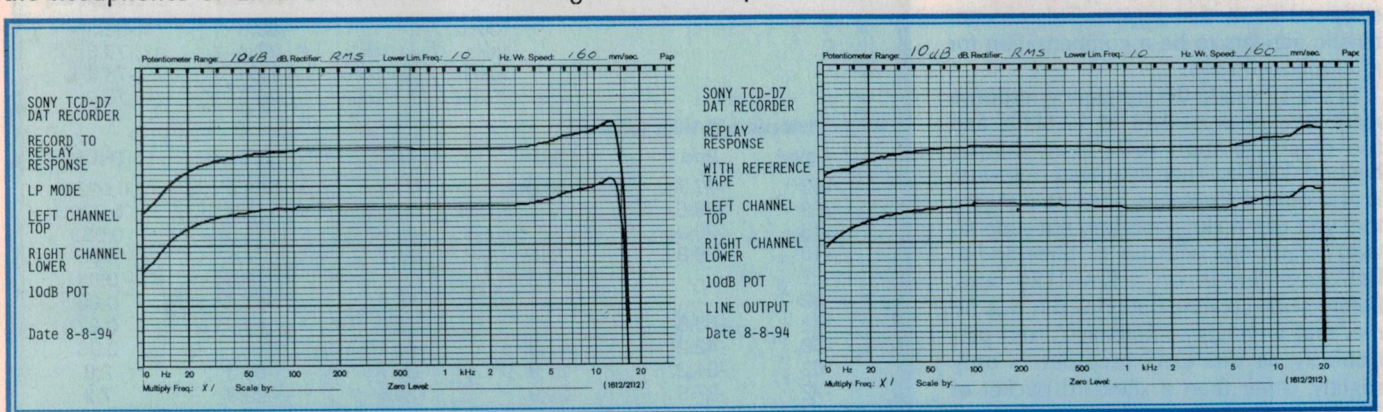
The other minor controls on the front panel include a small yellow PAUSE button, off-set to one side, a relatively large STOP and similarly sized PLAY button. These are flanked by separate small FAST FORWARD and FAST REWIND buttons. These are multi-mode buttons which function as cue and review, as well as finding tracks or fast forwarding or rewinding. The track required is determined by the number of times the button is pressed, (i.e., two presses moves you two tracks on from that being played).

Four other small pushbuttons are provided on the front panel. One of those is placed immediately beside the LCD display and provides a self-cancelling backlighting system. The three small buttons at the top of the panel are for setting the clock, for setting the counter, and the third for resetting those controls.

As I discovered, the recorder can keep track of the day and time. The LCD display provides indicators for peak recording level, the LP or SP mode, program number, start ID — and most critically, the residual power level available.

Other less frequently required display elements include a moisture warning. If there is any trace of condensation on the rotary head, it will tend to grab the tape and instantly destroy it. (This happened to me once, and I am now both sorrier and wiser.)

On the left hand side of the case is a nine-pin miniature socket that facilitates connection of convenient optical or conventional co-axial electrical connections to a special adaptor kit, the RM-D3K. This provides remote control of the TCD-D7, as well as timer operated



At left above is the measured record/replay response of the recorder in its 'Long Play' (LP) mode, again with the vertical axis expanded. At right is the response of the recorder when playing back a DAT reference tape.

recording with an additional Sony optional audio timer.

Other Sony hifi equipment may be connected using a special cable harness, with which we were not provided. Other optional extras which are available from Sony for the recorder itself include an AC adaptor, a car battery cord, and miniature microphones which may be directly powered from the recorder's microphone socket.

Sony have also developed a wireless remote control, which I am sure will be of interest to law enforcement agencies as well as to private investigators. None of these were provided to us with the recorder, but would undoubtedly have proven to be of great interest had they been offered.

Objective testing

The first phase of my objective testing was to determine the record/replay frequency response in standard play (SP) mode, as well as in the long play (LP) mode. As the traces emerged on the level recorder, I noted that the TCD-D7 displayed characteristics that I would not have expected, on the basis of my prior evaluations of other DAT recorders.

The first and most obvious difference was that the TCD-D7 exhibited significantly more droop at the lower end of the frequency range. The frequency response is typically -2dB at 10Hz, when the signal is fed through the line input. When the signal is fed through the microphone input, the low frequency droop is marginally steeper at the low frequency end.

"Trivial", you may say! Well, maybe it is. At the top end however, and in the 8kHz to 20kHz region, the recorder displays different characteristics between line and microphone input. When fed via the line input of the left channel, there is a 0.4dB rise in the 16 - 17kHz region; by contrast the microphone displays an even steeper rise in that region. This characteristic appears to be a compensation for microphone droop.

In the LP mode the frequency response exhibits a peak of 1dB at 12.5kHz and the response then rolls over sharply beyond 13kHz. That frequency response is also quite acceptable, because it means that you can make good (but not superlative) recordings with up to three-and-a-half hour length on a DA-R120 tape, before your alkaline batteries run out. To me, that is 'mighty impressive', and particularly as this DAT recorder is only slightly larger than a standard packet of 20 cigarettes.

The next parameter I evaluated was the dynamic linearity, from zero to -100dB. The results of that assessment were extremely impressive, as the maximum deviation that I could detect was only 0.1dB, apart from the -100dB level. Let's face it, my 95% confidence limits for those measurements would only be +/-0.05dB, and thus the precision of the generator and the related precision of the detector could account for a combined deviation which gave rise to those detected 0.1dB variations. So this aspect of the TCD-D7's performance was most impressive.

When I got to assess the distortion characteristics, the recorder's characteristics were again different to what I would have expected. The handbook cautions the user on the need to set the recording level, so that the peak level indicators on the display window flicker at around the '12' (-12dB) level. There is a good reason for this, as below -12dB the distortion levels are minimal. Between -12dB and 0dB the first or second stages of the analog to digital (A-D) converter introduce some degree of peak signal compression, and with it a consequent modest increase in the distortion level.

The distortion level does not really become significant until the signal level is more than 40dB below the -12dB point — i.e., -52dB relative to maximum recording level. At that level the total harmonic distortion is still less than 1%.

The measured signal to noise performance of the TCD-D7 is also impressive. The unweighted signal to noise ratio is 85dB, whilst the A-weighted figure is 91dB. Those noise figures are comparable to many CD players, but are marginally lower than the figures that I have measured on my existing or other full sized DAT recorders.

I tried to measure wow and flutter, but found that it was immeasurable. I then measured the peak line input levels, which are adjustable up to 230mV. The high microphone sensitivity accepts a peak signal level of 2mV, while the low sensitivity position accepts 22mV.

Listening tests

After a busy time testing and evaluating the TCD-D7's performance in the lab, I took it home to put it through its paces. When connected to the 'Tape 2' input of my system, I found that its controls were delightfully simple to use, and as I noted, designed to achieve optimum results with a minimum of fuss or bother.

SONY TCD-D7 PORTABLE DAT RECORDER
Model No. TCD-D7 / Serial No. 73993

1. **Frequency response** 20Hz to 20kHz +/-2dB

2. **Dynamic Linearity**

Nominal Level	Left Output	Right Output
-dB	0*	0*
-10	-10.0	-10.0
-20	-20.0	-20.0
-30	-30.0	-30.0
-40	-40.0	-40.0
-50	-49.9	-50.0
-60	-60.0	-60.0
-70	-70.0	-70.1
-80	-80.1	-80.1
-90	-90.1	-90.0
-100	-95.5	-96.0

* Input compression between zero and 9dB Left channel 0.7dB >right channel

3. **Channel Separation**

Frequency	Right into Left dB	Left into Right dB
100Hz	-68.8	-68.3
1kHz	-77.4	-77.5
10kHz	-77.5	-76.4
20kHz	-76.7	-76.0

4. **Distortion @ 1kHz (dB)**

Level	2nd	3rd	4th	5th	THD%
-12	-77.7	-86.5	-77.1	-84.0	0.0021
-13	-75.5	-	-77.4	-83.8	0.022
-15	-70.9	-	-83.7	-76.5	0.033
-18	-69.8	-72.5	-71.2	-77.6	0.05
-22	-	-77.3	-	-77.6	0.02
-32	-	-	-65.5	-67.4	0.08
-42	-53.8	-	-58.0	-	0.27
-52	-42.2	-47.9	-48.1	-	0.96
-62	-34.2	-37.9	-38.7	-38.3	2.8
-72	-27.3	-29.9	-29.4	-29.0	7.2

5. **Signal to Noise Ratio Measured Relative to OVU**
   Unweighted 85.1dB(Lin) A-Weighted 91.2dB(A)

I started playing some of my pre-recorded DAT tapes, the first being Sheffield Lab's DAT demo 'Direct from the Masters'. The sounds that it produced were clear, scintillating and absolutely stunning, and it sounded better than 95% of my CD's. I played half the tape before switching to 'Midori — Paganini's 24 Caprices for Solo Violin' (Sony SD44944). This time I could directly compare the pre-recorded DAT tape with disc, but now I couldn't really pick any subjective difference between the two formats.

Next I put a new CD into my CD player and called my wife (who is my operatic expert). I copied track two of Verdi's *Il Trovatore*, with Placido Domingo and James Levine conducting the New York Metropolitan Opera Orchestra and Chorus (Sony S2K48070).

This particular disc has been recorded with Sony's 20-bit 'Super Bit Mapping', and it is one of the best versions of *Il Trovatore* I've heard. I was careful to set the recording level so that the peaks seldom exceeded the -12dB point.

I set the disc to play four seconds in front of the tape copy. This greatly simplified the comparison, so that all I had to do was to adjust the playback levels so that they were identical. Then all I had to do was switch back and forth between CD and Tape 2, with the input selector.

As I soon found, neither my family, friends, nor I could tell or really pick any difference between any part of the recorded copy and the original. That is of course how it should be.

It didn't take me long to flatten the batteries (about 3 hours 20 minutes) — by which time I realised that this DAT player can put any other recorder I own to shame. It is smaller, lighter and easier to use, and it doesn't use nickel-cadmium batteries.

I didn't get the opportunity to take it on a field recording project, but if I had, then the TCD-D7 would be my first choice.

The only real dilemma that I'd have would be to pick the microphones. Yes, I have microphones that are as good, but they are each bigger than the TCD-D7 and mark you, they each cost twice as much...

If you want to record like a professional on an amateur budget, then this is the recorder for you. Its performance is positively stunning!

The TCD-D7 measures 133 x 88 x 37mm (W x D x H), and weighs a very modest 500 grams. It has an RRP of $1399.

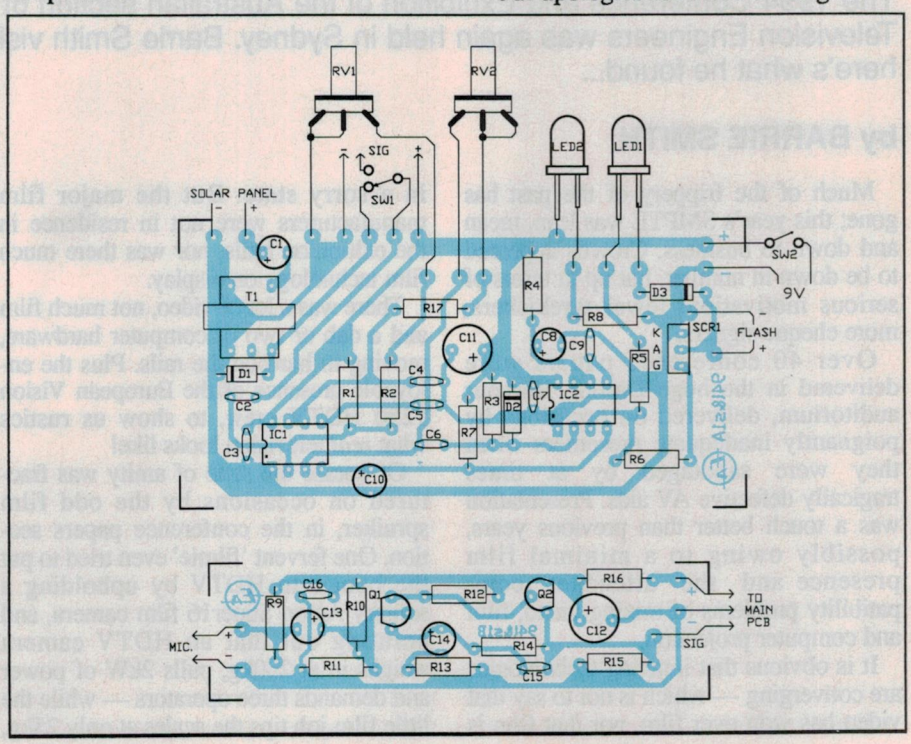
For further information contact your nearest Sony dealer, or Sony Australia at 33-39 Talavera Road, North Ryde 2113; phone (02) 887 6666. ❖

NOTES AND ERRATA

Light and Sound Trigger (April 1994): In the September 1994 issue we attempted to reprint the overlay diagrams that were printed in reverse in the original (April) publication of this project. However, the ***'Gremlin'*** made an unexpected appearance and this time the overlays themselves were not printed.

This month, we are making another attempt to get this project correct and are hoping that the overlay diagrams hereunder, are now printed the right way round and with the overlays in place, so that the readers interested in this project can now go ahead with their constructions at long last.

Our apologies for these oversights. ❖



CONVERGENCES: SMPTE 94

The 1994 Conference and Exhibition of the Australian section of the Society of Motion Picture and Television Engineers was again held in Sydney. Barrie Smith visited it as usual, on our behalf, and here's what he found...

by BARRIE SMITH

Much of the frippery of the past has gone; this year's SMPTE was lean, mean and down to business. Crowds appeared to be down in number, but up in terms of serious motivation: fewer tyrekickers, more cheque signers.

Over 40 conference papers were delivered in the huge Darling Harbour auditorium, delivered on occasions by poignantly inadequate presenters when they were sabotaged by at times tragically defective AV aids. Presentation was a touch better than previous years, possibly owing to a minimal film presence and the attendant compatibility problems of mixing video, film and computer projection.

It is obvious that imaging technologies are converging — which is not to say that video has won over film, nor that film is in a sorry state. But the major film manufacturers were not in residence in the exhibition halls, nor was there much film technology on display.

There was a lot of video, not much film and a dab or two of computer hardware, moving in hard on the rails. Plus the enjoyable presence of the European Vision 1250 HDTV crew, to show us rustics what *real* television looks like!

Of course the state of amity was fractured on occasions by the odd film spruiker, in the conference papers section. One fervent 'filmie' even tried to put the boot into HDTV by upholding a solitary Aaton Super16 film camera, and pointing out that an HDTV camera weighs in at 250kg, pulls 2kW of power and demands three operators — while the little film job tips the scales at only 25kg, needs no more than a small battery pack for power and the gentle control of one human. But what a human!

Patently obvious at the event was the imminence, for our region, of wide screen video as a production format.

Wide screen coming

To the front of the huge Sony stand were the company's — and industry's — first digital camcorder.

Showing the way, the Digital Betacam DVW-700P camcorder offers not only a 4:3 ratio, but a CCD (charge-controlled device) image sensor block which can be switched to 16:9 wide screen. The small (7kg) camcorder's head drum is 81.4mm in diameter, rotates at 2250rpm and has two sets of four record heads located at 180° to each other. The rotational speed

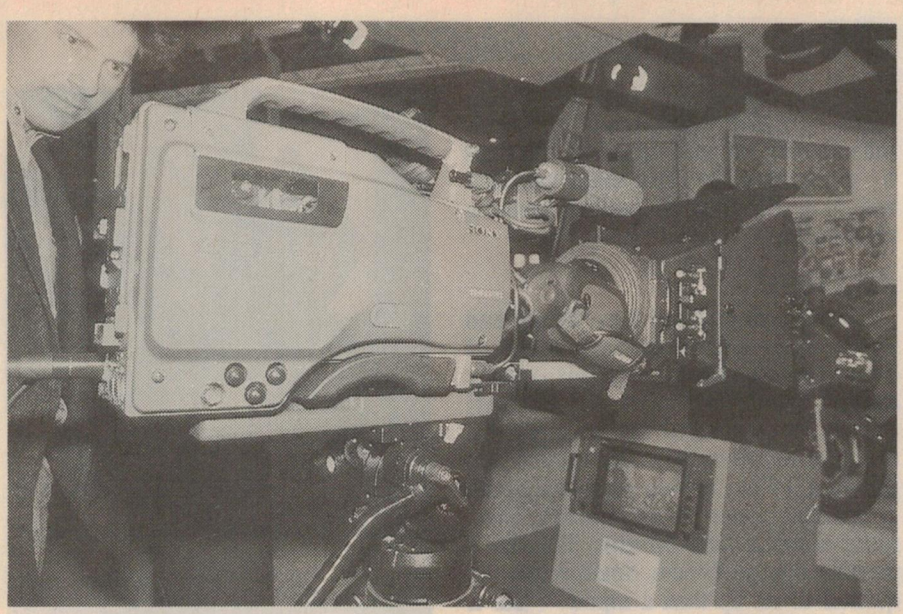
is the same as found in analog Betacam camcorders, and is acoustically quiet — after all, there is a mike in the camcorder's body!

The unit uses a Setup Card (a 2K EPROM) to set camera parameters, enabling a specific 'look' to be determined, stored for later use or even applied to multiple cameras on a shoot.

Lithium-ion batteries are used by the new camcorder, offering a size reduction and an avoidance of the NiCad 'memory' effect. The camera has already been ordered by a major rental company, as well as some production outfits.

Prominent on GEC-Panasonic's stand was the AQ-235W camera, also switchable from 16:9 to 4:3. The 'show' camera, an NTSC studio model, uses DSP (digital signal processing) on the M-FIT (multiple frame interline transfer) CCD's signal. Claimed to be the world's first progressive scan CCD camera, the camera is switchable to normal 2:1 interlace mode. In 16:9 ratio the CCD uses a 935(H) x 575(V) pixel array. Video output from the camera can be delivered in a wide range of signals: 16:9 at 360Mbps (18MHz) or 270Mbps (13.5MHz); 4:3 at 270Mbps (13.5MHz); analog component; analog composite; digital composite (D3 format). It's expected to be here in PAL next year.

The company still supports the S-VHS format, with a three chip, 700-line camcorder and various post production modules. On show also was a small colour camera — a three chip micro model offering 700 lines of horizontal resolution, and likely to be taken up by the medical fraternity.



Sony's new Digital Betacam DVW-700P camcorder, with a switchable 4:3/16:9 wide CCD block.

I spent a useful 10 minutes chatting to Berry Ebben, from Philips BTS in the Netherlands. His pride and joy was an LDK10 camera.

The camera is 16:9/4:3 switchable and is in high demand in Europe, Ebben explained, as a production camera for wide screen programming. The three 2/3" FT CCDs are switched between formats by a mere button push: 1000 pixels per line are delivered in each screen ratio, the image expanding vertically for the 4:3 mode. A variable speed shutter permits 'clean capture' of images from computer and other monitors with wide scanning speeds, anywhere between 61.1Hz and 103Hz in PAL. Light sensitivity at 2000lux at f/8 is claimed, with a minimum illumination level of 7.5lux at f/1.4 at +18dB.

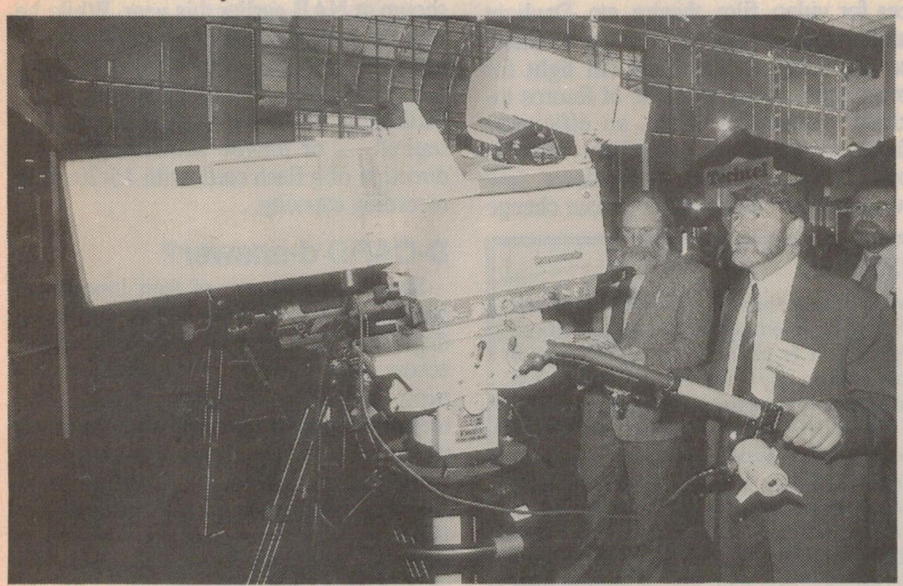
On the Hagemeyer stand were new JVC cameras and editing systems in the S-VHS format. While Sony's 8mm format is moving ahead in the consumer market, S-VHS is still attracting players in the low to mid end pro market.

Lens technology

Lens technology has apparently plateaued. Virtually the sole attraction on the Canon stand was a new zoom lens for ENG (electronics news gathering) cameras, incorporating the company's Optical Image Stabiliser. This opto-mechanical approach to image steadiness was derived from early work by the Schwemm Corp, then taken up by both Sony and Canon for consumer camcorders. And very well it works.

The steadying effect relies upon a pair of glass plates, placed within the optical path. The plates are separated by a high refractive index liquid, with their respective attitudes — and resultant refractive index — varied by vibration control sensors. The Canon ENG version has most effect on motion within the range 2-12Hz, and has little impact on image sharpness.

One area of lens technology still receiving attention is the incorporation of aspheric elements within a lens path, as shown in lenses from Fujinon. The benefits include lower wide angle distortion, improved corner resolution, wider zoom range and fewer lens elements in a design. Until now conventional lens cutting, grinding and polishing techniques have made aspheric element manufacture



Panasonic's AQ-235W camera, 16:9 to 4:3 switchable. The NTSC 'show' camera used digital signal processing on the multiple frame interline transfer CCD's signal.

at sizes in excess of 30mm diameter difficult. Fujinon approaches economic manufacture of the aspheric elements by preforming the glass shape and later softening the glass by heating, pressing and cooling.

And film?

Cinekinetics (from Las Vegas and Perth WA!) demonstrated a range of novel camera support systems, mostly made from lightweight aircraft aluminium. Their Pro SX Microjib will shoulder a 35mm Arri BL camera and pan in a 140cm radius, yet weighs only 10kgs and packs into a suitcase. Even more novel is their Nunano jib, with a panning radius of 46cm. Small it may be, quicker to set up than a tripod — but it still costs $2300!

The Samuelson/John Barry stand displayed the new Arriflex 535B 35mm camera — a snap at $300,000! It was hoped the group would be showing a new 20kW incandescent lamp and a 18kW HMI lamp — but due to excess demand in Europe, the lamps couldn't be spared.

Quinto drew big crowds around their $2 million Rank-Cintel Gold Ursa telecine. The video signal is digital all the way from the scanning PE cells to the 10-bit output at 4:4:4, with the equivalent of 5.5MHz resolution in each colour channel. Two are already in use in Australia.

Still with film: Rosco displayed for the first time their Cinemeter, a digital reading exposure meter. Using a unique bar chart display method the meter is an ideal tool for those cinematographers needing 1/6th f-stop accuracy, display in foot candles and lux and readout down to 0.05FC.

The Miller tripod people have taken product diversification to newer heights by adding the Noriyuki Scriptboy device to their inventory. Clipboard-shaped, the unit displays SMPTE/EBU time code and transmits code via a radio signal to any suitably equipped camera or VTR.

Radamec robotically controlled cameras systems. Multiple cameras can be controlled from up to eight control panels.

Another interesting Miller product is the Balcar range of fluorescent light sources for video, film, theatre, etc. Daylight and tungsten balanced tubes can be fitted, so providing an excellent fill light for most applications. Benefits of fluoros include shadowless effect, an efficiency factor of 4-8 times other light sources, cool operating, rapid startup/down, low weight/output ratio, and no colour change when dimmed. All that remains now is for lighting people to get their minds around the idea of a neon on set!

Robotics

Two companies showed examples of robotic camera technology. On the Quantum Pacific stand, English company Vinten showed not only a remote pan and tilt head but also a full blown robotic camera pedestal, which continued to startle visitors as it crossed their paths. The system, SP1000xy, can carry full size studio cameras and onboard autocues. Control is via a touchscreen and dual joystick arrangement, able to operate eight units.

This command centre simultaneously controls the zoom, tilt, pan and focus of up to eight cameras, as well as the X, Y and Z axis movements of their pedestals. 'Talent framing' can be preset, thereby keeping an on-screen personality acceptably framed. Motion control shooting is also possible, with a claimed ability to reposition the camera system to within 0.03141" (0.8mm).

Also from the UK, and located on the Techtel stand, was the Radamec range of robotically controlled camera systems. This company's products monitor happenings in the House of Commons, the US Congress, the European Parliament and the French National Assembly. Multiple cameras can be controlled from up to eight control panels, and allow interfaces to microphone selection systems, data tablets and touch screens.

Speaking with a Japanese representative for Ikegami cameras on the Bricast stand, I pursued the subject of the hard drive backed onto a camera head, shown at NAB earlier this year. While he was far from discursive on the matter, it appeared the company will be showing an operational model in NTSC next year. Still with the hard drive? Maybe, he replied — or maybe something in the direction of a flash card, with 15-20 mins recording capacity.

D-CARD d-answer?

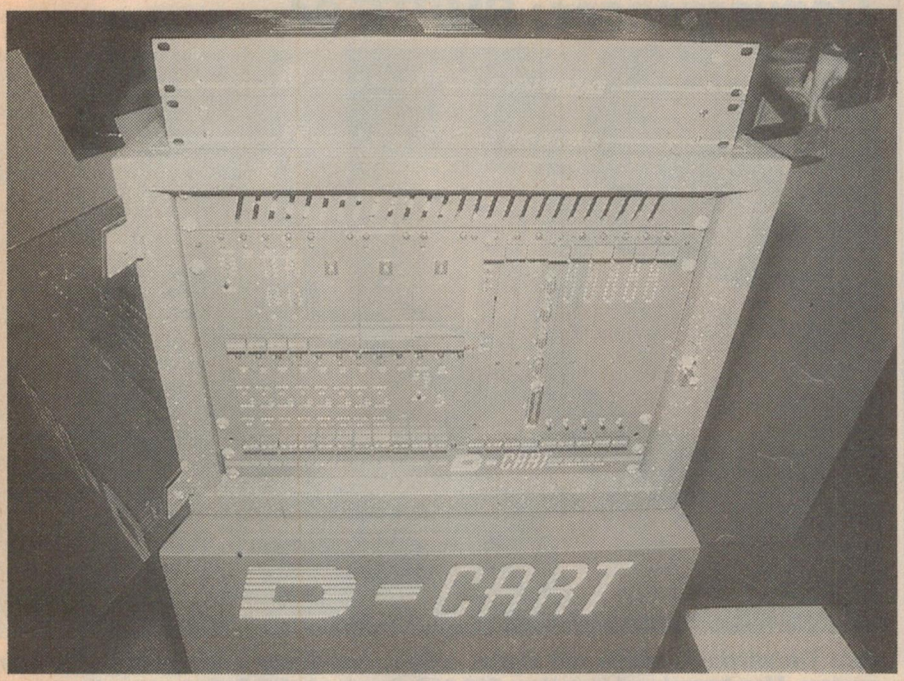
Showing awareness of their innovative creation, the ABC mounted a prominent display of its D-CART multi-user, rapid access audio system — currently winning friends in foreign climes. The technology's non-destructive, record, replay and editing systems are intended to replace reel to reel and analog cartridge based machines. Rep Matthew Holliday told me America's ABC Network has D-CART installations capable of replaying 180 channels and recording 80 channels, while radio stations in Paris and Hong Kong have also taken it aboard.

Vision 1250

The HDTV/wide screen seminar staged in conjunction with the SMPTE Convention drew a capacity crowd to the main theatre at the Film School, and consisted of addresses and screened examples of HDTV offered by executives from Kodak, HD Thames UK and the Vision 1250 group itself. The day brought an enormous response from the audience, due mainly to the superb quality of the film and video samples.

A tape from the HDTV coverage of Lillehammer evoked the most comment. Some interpolated material had been sourced from NHK's 1125 line Hi-Vision system and worked seamlessly. But the real thrill was the night opening ceremony and torch lighting. It is obvious the HDTV system loves black, high contrast levels and vivid colours but is less happy with pastels.

When HD Thames (now a production company) showed a range of commercial productions — fashion, office interiors, day exteriors, underwater shooting and a drama series, it became apparent HDTV is now the most likely competitor to high quality 35mm film. It lost out only in areas of extended shadow detail and in terms of a limited brightness range — watch those hot spots!



The ABC D-CART audio access system, now being taken up by overseas broadcasters.

Under development is a range of supporting products: MAVIS, an archiving system and LEXIPHON, a printed bar code intermeshed with related audio 'messages' offering language tuition and remedial reading.

Holliday admitted that D-CART Systems were "trying to move away from radio stations and expand into court reporting, transcription, archiving, etc. — anywhere there's a need for numerous users to access audio from a central library, making non-destructive, digital quality assemblies of the same piece of audio."

To be launched this year will be a video version of the audio access system, called V-Cart, as well as the first appearance of a completely new radio studio: D-RADIO. This is a fully digital on-air console, destined to go into the ABC's new Southbank Centre in Melbourne.

Pioneer showed a product of mainly consumer appeal: their CDJ-500 Pro CD player. This allows manual cueing, jogging, temp control and groove-sliding of CDs — all the tricks a DJ can pull with a pile of LPs. Disco nights won't be the same!

Big video

Most of us have had to grimace through the odd business AV presentation, miserably supported by dim, diffuse video projection on large screens.

Matters in that area are at last looking up, thanks to the continuing efforts by a long time manufacturer, the appearance of a new player and a refreshingly new approach to the task of getting video and digitally-originated images onto acceptably large display areas.

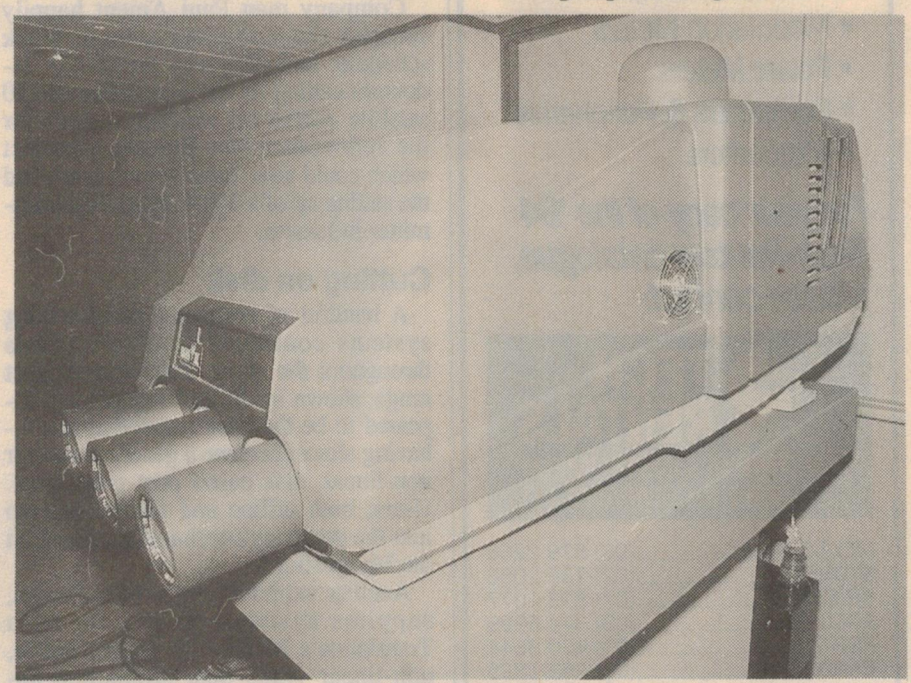
Belgian company Barco, well known for their high level reference video monitors, have long had a line of video projectors based on three-tube CRT technology. In recent years the company have spent time and money on the LCD route and have achieved significant improvements. On the Trace Pacific stand the new Barco 8100 Light valve projector was pumping out an 8000 lumen image with a resolution of 1020x768 pixels. Screen widths of 10 metres are achievable. Inputs can taken from Mac, VGA, Super VGA, XGA, S- video, component video, RGB analog via four slots with ten slot expansion capacity. Imaging is via a trio of 5.8 inch active matrix LCD panels; overall resolution of 1.3 million pixels.

The Vision 1250 group held a special HDTV day (see sidebar) in the Australian Film, Television and Radio School's main theatre, for a few hundred fortunate delegates. Used to project the tape- sourced HDTV images onto a six-metre-wide screen in 16:9 format was a pair of Seleco HDTV front projectors, hailing from Italy.

The machines used a trio of projection lenses, working from nine inch tubes in 16:9 aspect ratio. Little could be gleaned from the mostly French-speaking operator, but what was evident was the superb quality of the projected image put out by these 98kg behemoths.

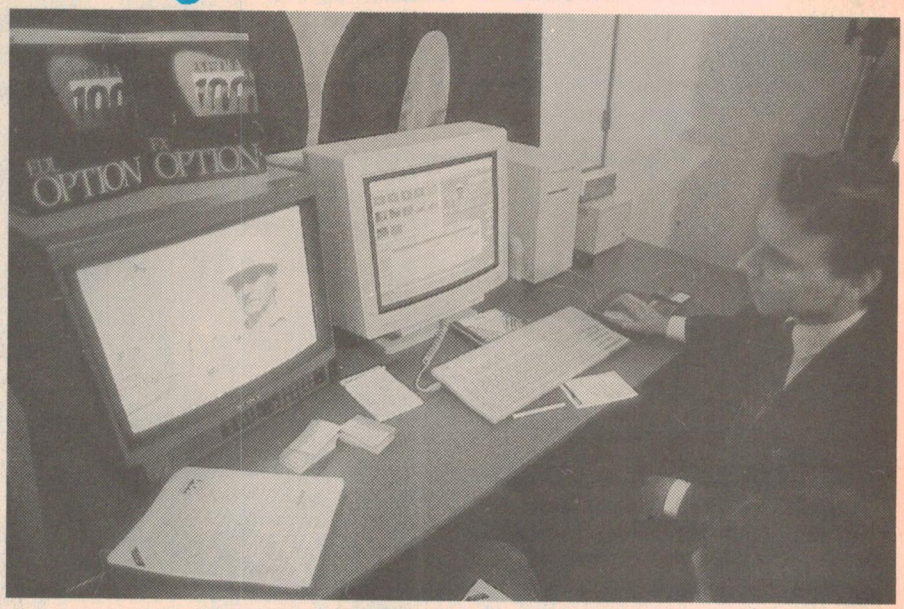
This writer was surprised to learn that both projectors ran in tandem, all the time that the superbly defined HDTV videos were shown. Apparently, all HDTV shows of this type in various parts of the world are obliged to use paired Selecos to achieve sufficient screen brightness for the eight-metre throw/six-metre wide display. On occasions, I was told, banks of four are deployed. How long it takes to line up all of the images in register, one can only guess...

Set high up in the 'gods' of the main



The 'dark horse' JVC/Hughes Super ILA projector quietly stole the show with its image quality.

Convergences: SMPTE 94



Data Translation's Media 100 digital, online, non-linear video post production system. Mac-based and less than $20,000, it outputs SP Betacam quality.

Darling Harbour auditorium as a front projector, and in rear projection configuration in the main exhibition hall, was another big screen device — the JVC/Hughes Super ILA projector. Founded upon 800 patents and ILA (image light amplification) this machine looks set to be the one to beat — regardless of whether the original signal is derived from video or a computer.

Showing a dish and a few racks of broadcast equipment was TV Australia Satellite Systems.

Company man Paul Ament happily recited the company's busy work schedule, including two projects in Indonesia calling for the installation of 250 satellite connected weather stations for the Indonesian Met Bureau, a project which could take 'quite some years', and the setting up of a 20kW stereo FM transmitter in Jakarta.

Cutting on disk

A handful of computer based editing systems continued to draw crowds throughout the show. The Avid product range, shown by Amber Technology, appeared to be the most comprehensive — having almost become a generic name for non-linear, disk-based post production. Users, both offline and online, can tap into the company's technology, based on the Mac platform.

Another exhibitor, Animotion Design, supplies systems centred on Data Translation's Media 100 digital, online, non-linear video post production approach. Also Mac-based, the less than $20,000 units have great appeal to small production companies and ad agencies, needing SP Betacam level output. Mark Richards happily confessed that nine outfits had been sold in the previous 10 weeks.

For the first time at an SMPTE show, I noticed the presence of Silicon Graphics workstations in Melbourne reseller Future Reality's small space. The firm's David Edgar explained that SGI has traditionally been the leading manufacturer of high performance graphics systems. About a year ago, he outlined, SGI introduced a computer called the Onyx, capable of manipulating D1 images in real time. Edgar felt "that was really the first nail in the coffin for dedicated hardware. When you can throw a D1 image around in real time inside a computer, then record to disk in real time at full resolution, it's a very sobering prospect."

Edgar's company is primarily marketting SGI product as alternatives to traditional suppliers like Quantel. In a 2D environment to do editing, multi layer compositing, special FX, paint, a typical system would be about $200,000 — including four minutes of D1 storage. This is around half the competition's prices.

Summing up

It is apparent from this year's SMPTE show that the production and broadcast industries are at the crossroads: new computer systems are becoming attractive for the former, while automation is becoming critically important for the latter.

The future looks to be very definitely a digital one, for both video and audio. ❖

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CABLE TV IN NEW ZEALAND

Although cable TV is only just starting up in Australia, a small cable system has been operating for over 18 months in the New Zealand town of Paraparaumu, north of Wellington. The author of this report has just returned from a trip to New Zealand, and while he was there the system attracted his attention. He thought many of *EA*'s other readers would find it of interest too...

by DAVID GRIFFITHS

While Australia still struggles with how and when we will have Pay TV, our friends across the Tasman have had their first Cable TV network up and running for some time. Perhaps surprisingly the network is not in one of the major cities in New Zealand, but instead it is based in a town called Paraparaumu (pronounced 'parra parra oo moo' in case you wondered), located approximately 50 kilometres north of Wellington on the Kapiti coast.

The network calls itself Kiwi Cable TV, and has been operating commercially since February 1993. Originally it was a purely local company, but has since attracted interest from an American company called United International Holdings, which now holds a 50% stake. UIH has extensive cable TV interests in Asia, Europe and Latin America, and Kiwi Cable hopes this input of US expertise and capital will expedite its expansion plans.

To date the network is connected to just over 1000 homes and motels. Their plans call for coverage from Paekakariki to New Plymouth (the area known as the Kapiti Coast), giving a potential reach of 92,000 homes.

Kiwi Cable TV's satellite dishes at Lindale. The smaller 10m dish points at the Intelsat bird at 180 degrees east, while the 15.7m dish points at an Optus bird.

The technology

Unlike the Australian intention of blazing the way with the latest in digital and compression technology, the New Zealanders have chosen the route of a proven coaxial cable based system. They are using a 12mm coax backbone, mainly suspended on power poles, feeding 6mm coax drops to each subscriber. Some underground cabling is used in heavily builtup areas. They are planning to move to an optical fibre backbone feeding local hubs in the future.

The channels on the cable are in the VHF range from 77MHz up to 266MHz, giving 35 channel capacity, with possible later expansion up to 400MHz, giving 48 channels. The system runs a pilot frequency at each end of the band, at frequencies of 77.25MHz and 266.25MHz, to permit level measurements and testing.

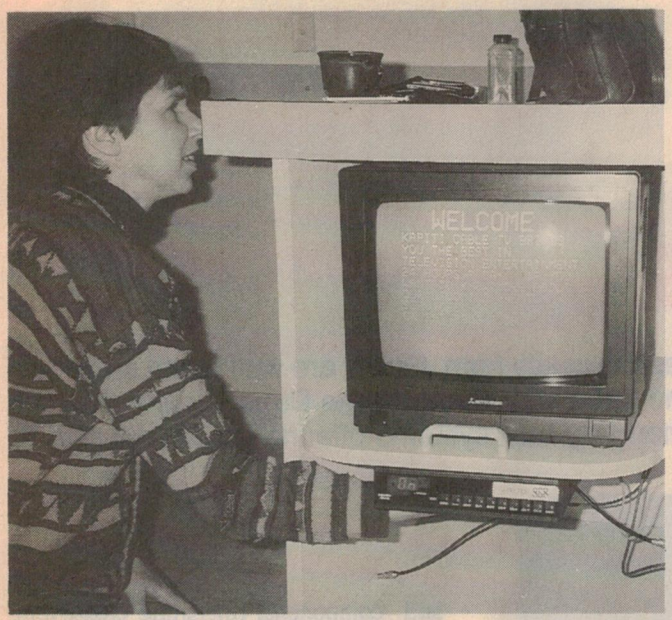
Each subscriber is supplied with a small decoder unit which attaches to the incoming coaxial cable and then feeds into the aerial socket of the television set. An infra-red remote control comes with the decoder. The set-top decoders are supplied by American manufacturer Scientific Atlanta and provide the cable company with the ability to individually enable or disable each subscriber on any of 60 channels.

The cable network has its base (called the headend) at Lindale, where it sports two fairly serious sized satellite dishes (see photo). One dish is 10 metres diameter and is looking at the Intelsat 180° satellite, and the other is 15.7 metres looking at Optus. They plan to make use of the new generation 703 and PanAmSat satellites once they are launched.

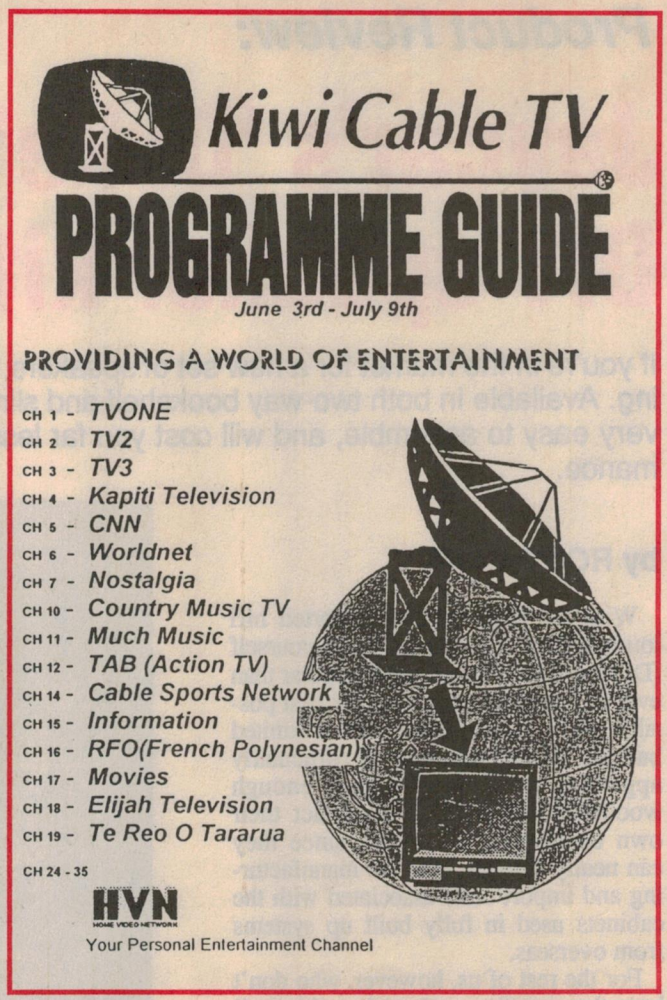
Program material

At present the network is broadcasting 15 basic channels which are available to all subscribers, plus a Movie on Demand system (often called pay per view) which allows subscribers to request one of a large selection of recent movies, at any time they wish to nominate, for an additional cost.

The basic channels include the three New Zealand free to air channels (TVONE, TV2 and TV3), Kapiti Television (local channel), US Cable News Network (CNN International), Worldnet, RFO (French Polynesian), a sports channel, Nostalgia movie chan-



Above: Taken in a motel room by the author, this photo shows the cable decoder box — usually called the 'set-top' box — but in this case, mounted underneath the set. To order a Movie on Demand, the user must ring up Kapiti Cable TV and quote the ID number on their decoder box.



Right: The front page of a typical programme guide for Kiwi Cable TV. As it shows, the first 19 channels are used to provide most of the basic programme services, with the remaining channels used for the Movie on Demand service.

nel, Country Music channel, Elijah Television (US religious programmes) and an All Movie Channel.

Including the normal free to air channels on the cable means that subscribers do not need to change over from the decoder to a local aerial connection when they want to watch normal programs. It also means they receive a high quality signal regardless of their geographical situation.

CNN is the 24 hour/day news service, which is probably familiar to most Australians now after their Gulf War exposure and regular midnight to dawn broadcast in Australia.

Worldnet is another US offering which includes the US Congress C-Span and other news and information programs such as the Macneil Lehrer News Hour and Deutsche Welle (German news in English). Both CNN and Worldnet are received in NTSC from Intelsat and converted to PAL at the headend. RFO is the program intended for viewers in French Polynesia and is entirely in French. It is originated in SECAM onto Intelsat and converted to PAL at Kiwi TV.

As well as the 'live' channels mentioned above, there are seven channels supplying movies, music videos and religious programmes which are using videotaped material from Vancouver.

There is also an information channel which cycles through about 20 pages of information about the service, program details and local weather and ski reports.

The sports channel at present consists mainly of an auto rotating teletext page giving updates of sports news. Some Australian football (league), replayed from the previous week and boxing is included. It is intended to expand this channel greatly when contracts can be negotiated. The dish pointed at Optus will probably figure in this plan.

Movies on demand

The Movie on Demand system (called Home Video Network) works by the subscriber selecting a movie from a constantly expanding list of recent release movies, and telephoning the network to request the movie and the time that it is required.

The subscriber quotes the identification number on the front of their decoder, which then allows the network to enable that single subscriber for a nominated 'spare' channel at the arranged time.

In theory, any subscriber can request any movie at any time. In practice however, there are only a limited number of replay machines and 'spare' channels available; but the law of averages means it works out fine most of the time.

What it costs

The service costs subscribers five dollars per week ($NZ5, about $AUS4.25) — plus 12.5% GST of course. There is no installation charge, and Kiwi Cable offers a one month free trial and then the first month free after that. Which all sounds quite a bit less than some of the price estimates that have been discussed for Australia for a lot less channels.

The Movie on Demand charges are $NZ7 per movie, with some movies being offered 'on special' for lower prices.

Included in the subscription is a weekly program guide mailed to each subscriber (see illustration).

About the author

David Griffiths runs an Industrial Control Computer Consultancy business and does some occasional freelance technical writing. He has a background in communications, television and computing. He has just returned from a visit to New Zealand. ❖

Product Review:

Jaycar's 'Duke' DIY speaker kits

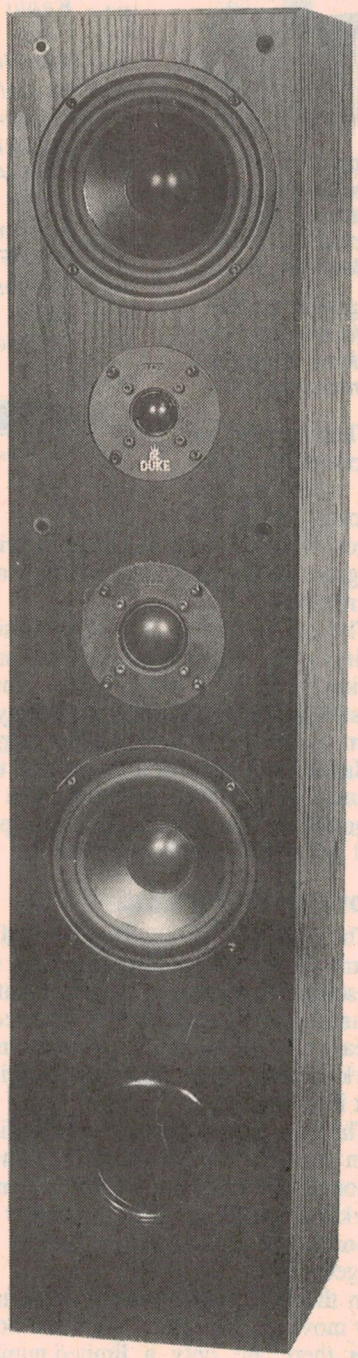
If you're in the market for a new set of speakers, these new kits from Jaycar are well worth considering. Available in both two-way bookshelf and slimline three-way versions, the Duke speaker kits are very easy to assemble, and will cost you far less than fully-built systems offering equivalent performance.

by ROB EVANS

With the high cost of imported hifi loudspeakers nowadays, do-it- yourself (DIY) speaker kits are more popular than ever as a method of getting the best possible sonic performance with a limited budget. This arrangement is particularly appealing to those who have enough woodworking skills to construct their own enclosures, of course, since they can neatly sidestep both the manufacturing and import costs associated with the cabinets used in fully built up systems from overseas.

For the rest of us, however, who don't have the expertise, tools and — above all — the time to build speaker enclosures, the tendency is to take the safe path of purchasing a fully-built speaker system and put up with the relatively high cost.

With the Duke speaker systems however, Jaycar have taken the middle road between these two extremes by supplying a kit with imported speakers and components (including crossovers, etc), and locally made *fully-built* enclosures. As you would expect, this avoids the high costs associated with imported cabinets, and eliminates the need for woodworking skills when putting the kit together. There should be no need to shy away from speaker kits, with this arrangement...



According to Jaycar, its Duke speaker systems still maintain the price advantage of traditional speakers kits despite the assembled cabinets, and complete imported versions of the speakers would be priced at around *double* that of the kits. As it stands though, a complete kit for a pair of the smaller two-way units (model DK11) sells for $399, and the kit for the large three-way system (DK77) is available for $689 — again, for a pair. The major parts are also available separately, with the speaker/crossover kits (no cabinets) at $229 and $399 respectively, and the cabinets priced at $170 and $290.

The DK11

Constructed in conventional bookshelf style, Duke's two-way unit measures 210 x 255 x 390mm, contains a heavy-duty 150mm bass driver plus a 25mm dome tweeter, and has a power rating of 60W RMS.

The bass reflex enclosure uses a molded plastic port tube with a 26 x 51mm opening, and as you can see from the photo, is arranged with bass driver positioned at the top of the cabinet and the tweeter near the center. Presumably, this rather unconventional arrangement helps to bring the tweeter nearer to ear level when the DL11's are installed in a bookshelf unit, or mounted on a wall.

Other than that, the 'MDF' chipboard enclosures appear to be well constructed,

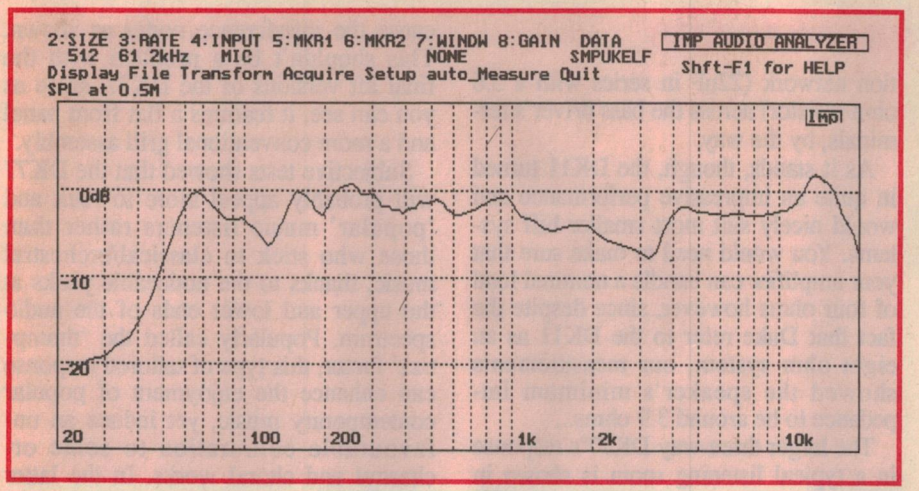


Fig.1: The frequency response plot of the smaller DK11 speaker in a typical room, as produced by our IMP measuring system.

are finished in an attractive 'blackwood' veneer, and have matching (also black) grillcloth assemblies which snap into recessed sockets in the front panel. Each cabinet's rear panel holds a molded plastic speaker terminal block, which uses large connecting posts (suitable for heavy duty speaker cable) and doubles as a mounting point for the crossover network.

The crossover itself is a simple first-order affair using one large iron-cored inductor, a plastic-type capacitor and a single 5W resistor. These are all installed on a small PCB which mounts directly on the speaker terminal block, as mentioned, and is fitted with flying leads for the driver connections.

The Duke drivers appear to be suitably rugged units, with the 150mm bass speaker sporting a 25mm voice coil, a polypropylene cone with a rubber surround material, and a large '12 ounce' magnet assembly.

According to the supplied literature, the 25mm tweeter unit uses a soft fabric coated dome material, and is 'ferrofluid' cooled — this tends to provide a damping action for the dome/coil assembly and also enhances the driver's continuous power rating.

The DK77

Not surprisingly, the same basic construction techniques and drive units used in the DK11 are employed in Duke's larger DK77 three-way system, which is rated at 120W RMS. In this case, *two* parallel-connected bass drivers are used in a vented reflex-type enclosure, with an additional driver unit installed to cater for the midrange area. This latter driver is a 50mm dome (rather than cone) unit, and features a 50mm voice coil driving a fabric coated dome assembly.

The DK77's cabinet measures 210 x 285 x 980mm, is vented by a heavy-duty cardboard port with a 86mm diameter, and the crossover unit is mounted inside the box, rather than supported by speaker terminal block as in the DK11. And as you might expect, the crossover is a first-order *three-way* unit, and uses iron-cored inductors as before.

As you can see from the associated photo, the unit's driver layout is also slightly unusual in that the bass drivers are positioned on either side of the midrange and tweeter speakers. Presumably, the idea here is to place the tweeter at a suitable listening elevation when the DK77's are standing on the floor — which of course is their intended position.

Assembly and tests

Thanks to the pre-built enclosures supplied with the Duke speaker kits, both the DK11 and DK77 are very easy to put together — all you really need is a Phillips head screwdriver and about half an hour of free time.

With the DK11's, once the speaker terminal blocks are screwed in place and cabinet stuffing (Innerbond) installed, the drivers can connected to the crossover's flying leads, then screwed into the cabinet cutouts — the vent tube is a simple push fit, by the way. An appropriate number of screws are supplied with the kit, the crossover leads are colour coded, and the speaker lugs are marked accordingly.

Besides having to install a larger number of drivers, the only real difference in the assembly procedure for the DK77 is that the crossover assembly is screwed to the rear panel, and the outer end of cardboard vent tube is fitted with a molded plastic dress ring. Once again, the speaker 'construction' process is quite straightforward and can be completed in a number of minutes.

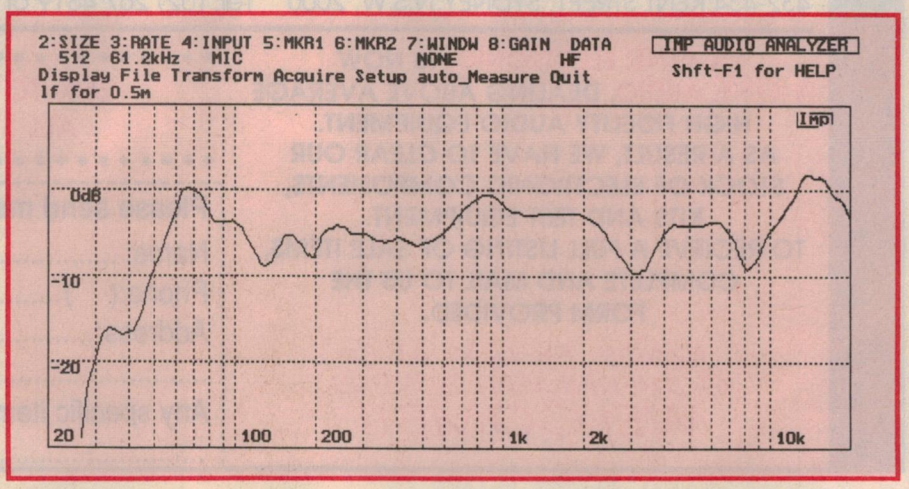


Fig.2: IMP's response curve for the DK77 three-way system, with the test microphone at a distance of 0.5m from the tweeter.

Jaycar's 'Duke' DIY speaker kits

Our only criticism of the way in which the Duke speakers are assembled is the doubtful quality of the air seal between the various components and the cabinet panels, since the kit does not include any form of sealing material (say, flexible caulking compound). This in turn means that the overall sound quality could be compromised by the audible effects created by air turbulence through these leaks, which are driven by the pumping action of the bass driver's cone.

Fortunately though the solution is quite simple, and only involves the judicious application of a sealing material at the critical areas.

Caulking compound, or even a silicon sealant could be applied to the perimeter of the speaker terminal plate and the vent tube flange, while some form of rubber sealing gasket (say sections of thin 'draught strip') might be used around the inner rim of the drivers.

Performance

Both the DK11 and DK77 performed well in our listening and subsequent measurement tests, and exhibited a reasonably smooth response and a commendable bandwidth.

The DK11 covered the range of 55Hz to 18kHz, with a noticeable peak at about 14kHz and a dip in the response around the 3kHz region — see Fig.1. After a little investigation, we found that the high frequency peak was due to a resonance produced by the tweeter's dome material, and the dip was caused by the crossover responding to the rising impedance of the bass driver's voice coil. This latter effect could be largely cancelled by the addition of a compensation network (22uF in series with a 5.6 ohm resistor) across the bass driver's terminals, by the way.

As it stands, though, the DK11 turned in quite an impressive performance and would nicely suit most smaller hifi systems. You would need to make sure that your amplifier can handle a nominal load of four ohms however, since despite the fact that Duke refer to the DK11 as an eight ohm system, our measurements showed the speaker's minimum impedance to be around 3.9 ohms...

The larger three-way DK77's response in a typical listening room is shown in Fig.2. Here, the response again shows a peak at around 14kHz as was the case with the DK11 (it uses the same tweeter unit), and a couple of midrange dips at 3kHz and 8kHz, plus a peak at 65Hz due to the cabinet's tuning alignment. The response falls rapidly below this point, resulting in an overall nominal bandwidth of about 50Hz to 20kHz.

While the reason behind the midrange dips was a little hard to deduce at first, it became clear that this was mainly due to interference created by the front baffle arrangement on our sample of the DK77 — this is not the one shown in the associated photo, by the way. The prototype unit featured an upper and lower grillcloth assembly (two per enclosure) which were separated by a raised section on the front panel, rather than the usual single-piece grill assembly as used in the final kit.

As it turned out, the raised section between the two grills (a shaped section of MDF board) was positioned between the midrange and tweeter drivers, and the close proximity of its edges seemed to cause the interference nodes as shown. This shouldn't be a problem with the final kit versions of the DK77, since as you can see, it features a flat front panel and a more conventional grill assembly.

Subjective tests showed that the DK77 will probably appeal more to rock and 'popular' music listeners rather than those who stick to classical/orchestral music, thanks to the noticeable peaks at the upper and lower ends of the audio spectrum. Popularly called the 'thumptizz' factor, this type of tailored response can enhance the enjoyment of popular contemporary music, yet induce an unfavourable colouration to some orchestral and choral works. In the latter case though, some judicious adjustment of the amp's tone controls improves matters considerably.

We also found that like the DK11, the DK77 is nominally a four ohm system (it uses two 8-ohm bass drivers connected in parallel), so you will need to be sure that your amplifier is capable of handling that impedance. This shouldn't be a problem with virtually all contemporary amps, however — particularly those with a power capability to match that of the DK77.

All in all then, both of the Duke speaker kits appear to represent good value for money, and achieve an effective balance between the cost of fully imported systems and the ordeal of constructing enclosures from 'scratch' to suit a driver/crossover kit.

The Jaycar kits are complete down to the last screw, are easy to put together, and have an attractive and professional final appearance. Also, by the time you read this you should be able to audition both systems in advance, at your nearest Jaycar store. ❖

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READER INFO NO. 9

Using radio astronomy to observe

THE SUDDEN DEMISE OF FRAGMENT 'K'

When the various pieces of comet Shoemaker-Levy 9 were slamming into Jupiter, a couple of months ago, an intrepid trio of well-insulated radio astronomy enthusiasts journeyed one night to the quietest (and coldest) spot in Tasmania, to record some of the action. One of the team was Grote Reber, internationally recognised as the 'father' of radio astronomy; another was technical college teacher and keen optical astronomer Eric Baynes. The third was our regular columnist Tom Moffat, and here's his account of their expedition.

by TOM MOFFAT

Mid-July 1994 saw the world in the grip of comet fever. Nay, not just the world, the whole solar system... because the Comet Shoemaker-Levy 9 was going to smash into Jupiter. This wouldn't be a 'big bang' as such; the impact was going to happen machine-gun style. The comet had broken apart after a previous close encounter with Jupiter (wouldn't *you*?) and now the fragments were headed toward Jupiter in a stream that would bombard the planet over a week. The word 'fragment' wasn't really the right word for these pieces; some of them were several kilometres across, as big as mountains.

Many *EA* readers may have first heard about the comet in the July issue, with my article 'Jupiter Squawks!' — but the mainstream media studiously ignored it. Then the comet appeared on the cover of *Time* magazine, streaking toward Jupiter in all its glory. This finally inspired stories in the popular press, like the one that said the comet smashing into Jupiter was going to cause a new ice age on Earth. (I gather this one started as speculation about what would happen if a similar comet hit Earth. Then the 'hit Earth' part somehow got deleted, and we were going to get our ice age from Jupiter.)

Guesses about what would happen to Jupiter ranged from its transformation into a second sun, to a complete fizzer. More serious scientific opinion suggested that there could be some interesting sights to see, but a telescope with a 15" mirror would be the minimum required to see them. And as it turned out, this wasn't far off the mark...

What we didn't hear much about was what what could happen further down

"Come on clouds, clear off!" Grote Reber (L) and Eric Baynes watch impatiently in the hope that the clouds would clear and allow them to watch the impact with Eric's 5" reflecting telescope. They did clear, in the end.

Impact minus three hours, at Dennistoun. The antenna is up and the sun is going down, with a few promising breaks in the cloud cover. Maybe we'll see something after all — as well as picking up some signals on 20.054MHz...

"Hey, I can use this!" Eric Baynes and Grote Reber salvaging interesting and hopefully useful 'junque' from the Dennistoun site, during the inspection trip. This was the site of Reber's historic 2MHz radio telescope antenna array.

the electromagnetic spectrum — at radio frequencies, well below those for light.

Jupiter has always been a top performer radio-wise, regularly emitting distinctive noises particularly on the low frequencies (for radio astronomy) of around 8 - 30MHz. Much of this activity involved interaction between the Jovian moon Io and the planet's Van Allen radiation belts.

See it on radio?

Some of us reasoned that if a moon closely orbiting Jupiter could make so much noise, a mountain-sized chunk of comet coming in at something like 200,000 kilometres an hour should really make Jupiter sit up and bark. So a small radio astronomy expedition was organised, to be led by the man recognised as the father of radio astronomy: Grote Reber.

As well as nearly 60 years of radio astronomy experience, he has access to what must be the quietest radio site in the Southern Hemisphere — Dennistoun, in central Tasmania.

Our party consisted of three: as well as Grote Reber we had Eric Baynes, head teacher of electronics at Hobart Technical College and a keen optical astronomer. He owned a decent 5" reflector telescope and had access to a 12" model. The third team member was me. I supplied all the radio receiving apparatus, which was prepared under Grote Reber's guidance.

For several months prior to impact, astronomers the world over were tracking the progress of the comet, all the

The Sudden Demise of Fragment 'K'

Is the antenna resonant at 20MHz? Eric Baynes makes the final test by tuning the receiver a megahertz higher and lower.

while taking some lovely pictures that made it look like a string of pearls. The ones from the Hubble Space Telescope were particularly impressive.

The fragments had been given labels — A, B, C, etc. It was soon possible to predict the times of impact for each fragment, initially with error margins of half an hour or so. We needed to know which fragment impacts would be visible from Australia.

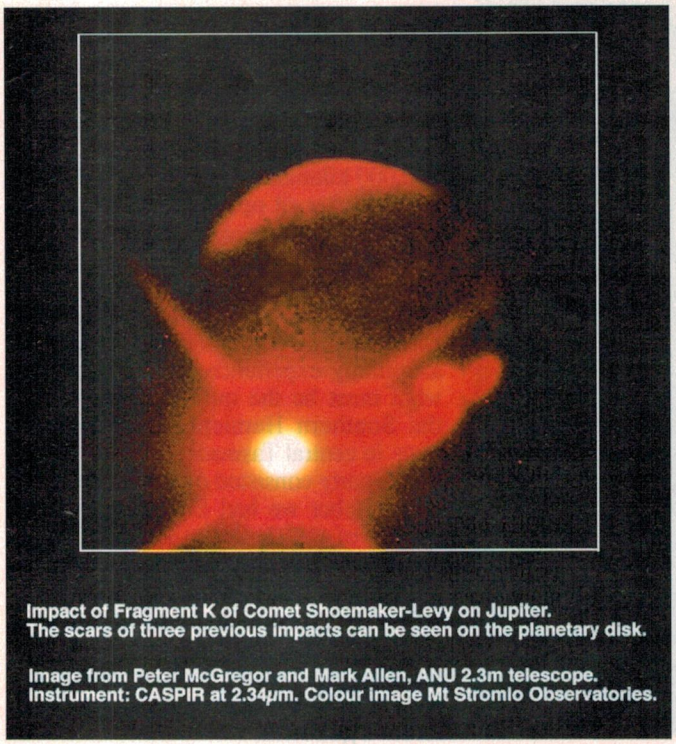
With the help of the Skyglobe computer program (see July *EA*), we worked out the times each day during the impact period when Jupiter would be 'up' in our sky. We also wanted the sun to be 'down' so as to permit optical observation of Jupiter, and to minimise any noise the sun might contribute to our radio observations.

The position of the moon was also important, so its light would not blot out Jupiter. Another consideration was Eric's working hours — he teaches night classes, so he had to have the night off.

With all things considered, we chose Fragment K as our first target. It met all the important criteria, and was a big one as well. Predicted impact time at that stage was 8:40pm on Tuesday night, July 19. We also chose a secondary date of Friday, July 22, in case Tuesday's attempt was wiped out by equipment failure or nasty weather. There were to be two impacts on Friday, one daytime and one nighttime, but the fragments were small and Jupiter was fairly low in the sky. Still, Friday made a good backup.

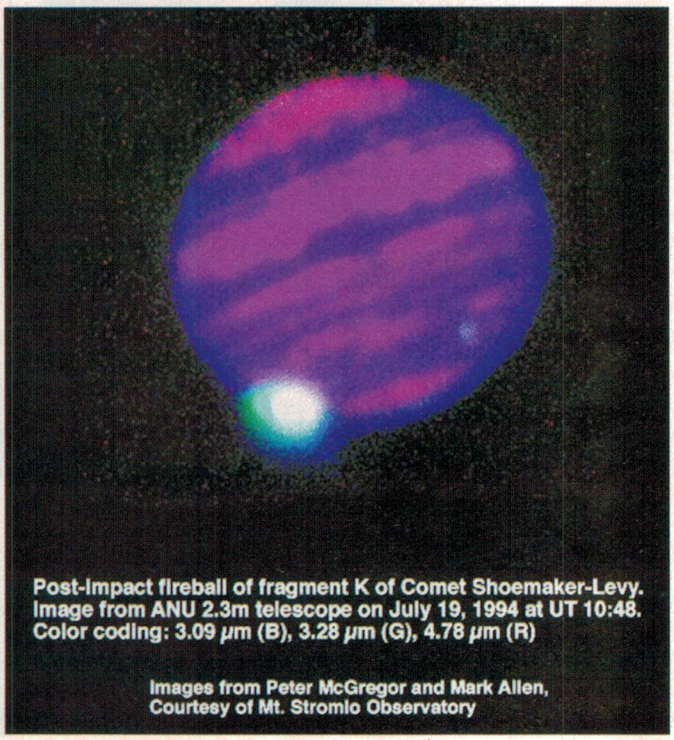
A couple of weeks before 'Comet Day', Eric and I drove to Bothwell, picked up Grote Reber from his home, and headed for the Dennistoun site to check it out.

What a spooky place! But it just reeked of radio history. It was dead flat for several kilometres in each direction, with a mountain range to the north. And everywhere you looked, there were enormous light poles which had supported Grote Reber's gigantic 2MHz radio telescope antenna. All that was left now were the poles; most of the wires had long gone. But back in the 1960's, this



Impact of Fragment K of Comet Shoemaker-Levy on Jupiter. The scars of three previous impacts can be seen on the planetary disk.

Image from Peter McGregor and Mark Allen, ANU 2.3m telescope. Instrument: CASPIR at 2.34μm. Colour image Mt Stromlo Observatories.



Post-impact fireball of fragment K of Comet Shoemaker-Levy. Image from ANU 2.3m telescope on July 19, 1994 at UT 10:48. Color coding: 3.09 μm (B), 3.28 μm (G), 4.78 μm (R)

Images from Peter McGregor and Mark Allen, Courtesy of Mt. Stromlo Observatory

These two images were found by Tom Moffat on the Internet, a few days after the impact. As you can see, they were taken by scientists Peter McGregor and Mark Allen, at Australia's Mount Stromlo Observatory. The image on the left shows the impact, and that on the right the post impact fireball, as seen at various wave lengths in the infrared spectrum.

antenna had made the first ever low-frequency radio map of the southern sky.

Right in the centre of the array was a circular fence, which had once protected Grote's equipment hut from the marauding cattle that inhabit the Dennistoun property. Smaller poles radiated out from the hut carrying feeders for the main antenna. The hut had disintegrated, but the nearest feeder pole was still intact, offering its services one last time as a potential antenna support. So we decided that's where we would listen for Jupiter, at 'ground zero' so to speak. A very historic spot!

Grote hadn't been out to the site for more than three years, and he was just like a kid with a new toy. He'd say "let's look at this" or "let's go over there and look at that", and off we'd head off to inspect some radio telescope remains. "Hey, I can salvage that!" he'd say, and Eric and I would pick the thing up and cart it back to my station wagon.

When we eventually got back to Bothwell we had a whole car-load of brackets, bits of wood, wire scraps, and insulators. Most of the insulators had been trampled on by the cattle and broken, but I managed to salvage two good ones — one glass and one porcelain — by digging them up from below the ground where the cattle couldn't get at them. After a trip through the dishwasher they now occupy places of honour on my desk, as cherished souvenirs of Australia's radio history.

K-Day: July 19

By now, information on the comet was flowing fast and furious on the Internet, the world's biggest computer network. I'd been checking in daily to the sci.astro newsgroup, and then taking an hour or so to sort through all the messages posted therein. Among them were updated impact predictions, with the latest showing Fragment K at 8:18:32pm local time. This took into account the 45 minutes travel time for light (and radio signals) to get here from Jupiter.

All the fragment impacts were to take place on a part of Jupiter not visible from Earth. But hopefully there would still be a mighty flash, both radio and optical, seen over Jupiter's horizon. In the case of Fragment K, the impact site was predicted to rotate into view 13.7 minutes later.

At 2:00pm on the day, Eric and I load the gear into my car. There's heaps of stuff — electronic equipment, food and water (we're having a pre-impact barbecue at the Dennistoun site) and on the roof rack a lightweight telescopic antenna mast. We've decided to abandon the 12" telescope; the day is fairly cloudy and we think it's unlikely we'll do any optical astronomy at all. Nevertheless, we decide to take Eric's 5" telescope along, just in case the weather clears up.

At 2:30pm, we stop on the outskirts of Hobart to buy more food, petrol, gas for the barbecue, and a big bottle of Stone's Green Ginger Wine. This is strictly for medicinal use against the freezing night air.

The countdown begins.

3:30pm: Eric and I arrive at Grote Reber's house in Bothwell. "You're early!", he says, but we need enough time to set up all the equipment while there is daylight. Grote says maybe he shouldn't come along; he doesn't like the idea of waiting in the cold for five hours. We decide to leave him there for the time being and come back and pick him up at 7:00pm so he's only got an hour or so in the cold. Grote says he'll be standing at his gate.

4:00pm: We reach the Dennistoun site with a bit over an hour of good daylight left. We have to get the antenna up quickly, and I want to try to get a few pictures of the site before we lose it in darkness.

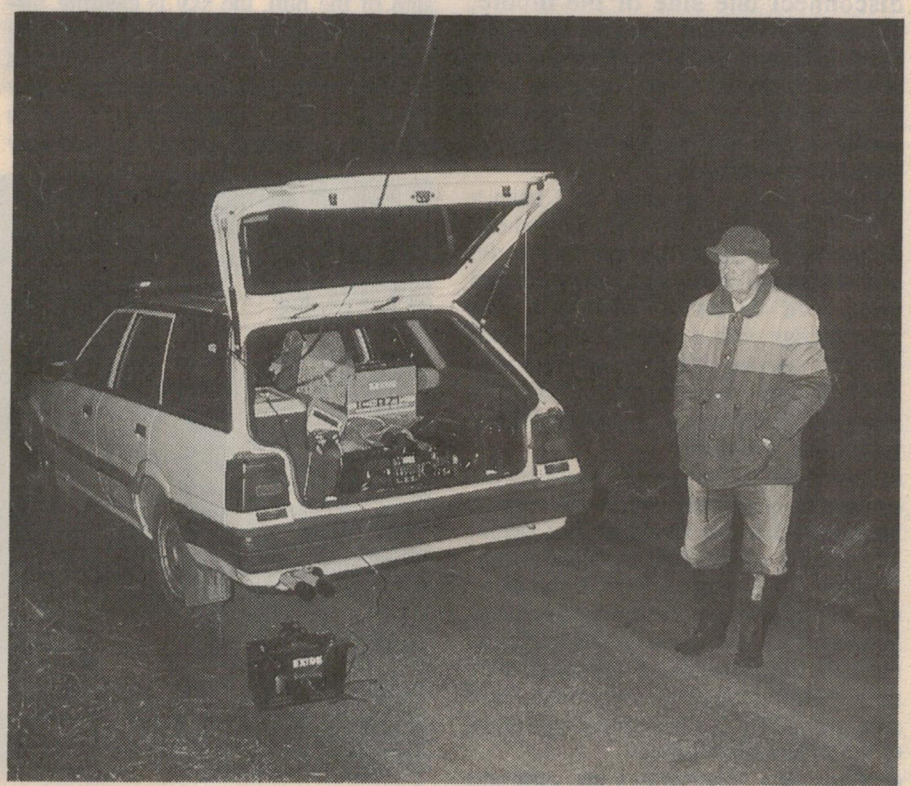
The antenna is exactly like the one described in the Jupiter Squawks article — a half-wave dipole of 300 ohm twin-lead with holes drilled in the insulation and threaded onto a length of nylon rope. Grote Reber's feeder-pole we have selected has a crossarm at the top, about five metres above the ground. We toss a rope over the crossarm and attach it to one end of the antenna rope. Then we pull the antenna rope over the crossarm and tie it to a stick jammed into a hole in the pole.

At the other end of the antenna we lay out the telescopic mast with the antenna rope and two guy ropes tied to its top. Then I lift the mast vertical and hold it, while Eric drives in two stakes for the guys. The job's done in a few minutes, and, by sheer luck, the antenna is horizontal. The telescopic mast is exactly the same height as the old timber pole.

The twin-lead feed line is hanging down in the dirt road where we intend to put the car, exactly where we want it. Is this a good omen?

4:30pm: We move the car into position and arrange our Icom R-71A receiver, a Sony professional cassette recorder and a spectrum analyser, all facing out the station wagon's back end. The raised tail gate will provide shelter if it rains (we hope!). We connect the antenna, through a balun, to the receiver which has been modified to run off a big 12 volt boat battery.

When we switch on the radio, we hear almost total silence. This is a worrying



Recording is under way, and Grote Reber waits and watches. Note the boat battery powering the receiver, and the 300 ohm twin lead heading up to the centre of the 20.054MHz dipole antenna.

development. Is something wrong? So we swing the antenna over to the spectrum analyser and try again. The instrument is supposed to measure well below a microvolt, but we get a completely flat line while sweeping between 15 and 30MHz. At around 70MHz we see the ABC television transmitter coming through weakly on our 20MHz antenna, so something must be working.

We reconnect the receiver and tune to 20.054MHz, where we intend to listen for the comet. This frequency was chosen because even when the 20MHz band is hopping with terrestrial signals, I've never heard a thing on 20.054. So if the band unexpectedly opens tonight, we should be safe from interference.

But now on 20.054, there is nothing but gentle hiss. This place is indeed 'radio quiet'. If we disconnect the antenna the hiss decreases, proving that it's incoming and not just noise in the receiver's front end. We're many kilometres from the nearest power line, in fact many kilometres from ANYTHING. So we hope what we're hearing is from cosmic sources.

Just for fun we drop down to the AM broadcast band, and it's pretty dead too. This is not surprising, since the antenna was designed to work on 20MHz. So we disconnect one side of the dipole, destroying its balance, and the broadcast band springs into life. We're hearing stations from all over Australia, and it's not even dark yet. And between the stations, just the quiet hiss. This site certainly has promise...

5:00pm: It's getting dark, so I snap a few pictures. Then it's time to feed our faces. We unpack the gas barbecue, and the gas bottle, and all the pots and pans and dishes, and begin the proceedings with a cup of coffee. Once we start cooking it's dark; we forgot to bring the gas lantern, and I burn the sausages. We console ourselves with a few snorts of Stone's.

6:00pm: We listen to ABC News on the car radio. They announce that comet Fragment G is due to impact at 8:08pm, 10 minutes earlier than the time on our 'official' impact schedule from the Internet. But they've got the wrong fragment; Fragment G had already impacted the night before. So we suspect that their time is wrong too. Still, to be on the safe side, we decide it's best to try collecting Grote Reber a little early.

6:35pm: We disconnect the antenna (glad we remembered to do that...) and I hop in the car and head back to Bothwell to get Grote. The cloud has cleared off somewhat, so Eric has decided to stay behind to set up his telescope. As I back the car away I see him in the headlights, fiddling with the many adjustments to 'align' the telescope. More cloud is disappearing, the moon is out, and things are looking more and more promising.

A hundred metres along the road my way is blocked by an enormous bull, standing there glaring at me. It's like that scene out of *Crocodile Dundee*, where Paul Hogan and a bull stare each other down. I flick the headlights at him, he moves (grudgingly), and I drive on.

Then I think — what if that bull sees the white telescope gleaming in the moonlight and goes over to investigate? Should I go back and warn Eric? It's a wide-open paddock and there's not even the car to hide behind. Well, maybe Eric can jump the fence where the equipment hut used to be. I've got to keep moving — got to get to Grote on time.

6:55pm: I arrive at Grote Reber's house just as he's coming out to wait at the gate. So we get a little head start. Driving back to Dennistoun we listen to the ABC seven o'clock news and they repeat the comet story as before — Fragment G at 8:08. No problem now, nothing can stop us (except perhaps the bull).

7:30pm: Back at the Dennistoun site. No sign of the bull, the sky is clearing further, and Eric has the telescope working nicely. We can clearly see the bands around Jupiter and two of its moons. Our view is so close that the third moon is outside our field of vision; we can only see it by moving the telescope slightly. In fact, the telescope is so sensitive that we can make the image wobble by jumping up and down on the ground five metres away. Maybe it will make a good bull detector...

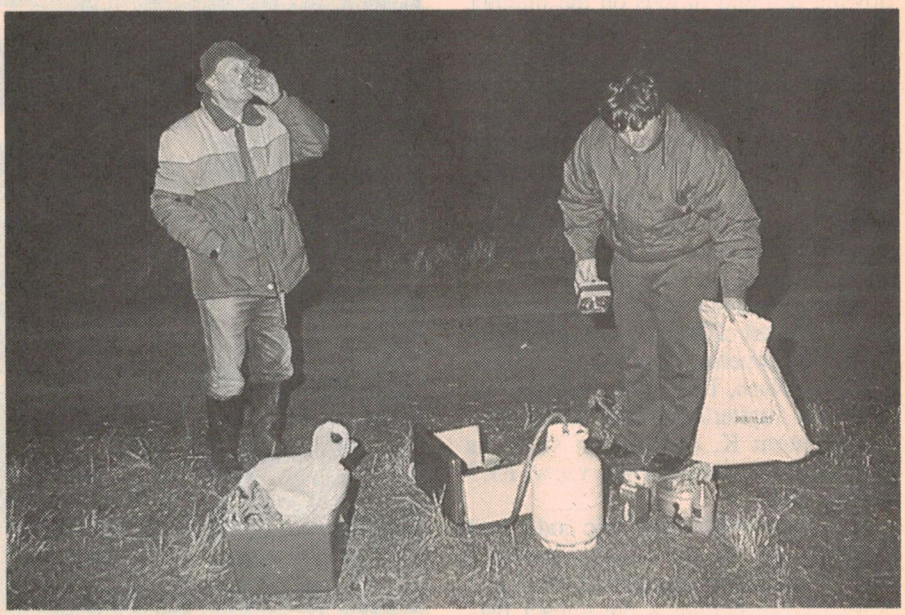
Grote has a turn looking through the telescope (his 82-year-old eyes still work fine), while I go to the back of the car to re-connect all the radio gear. Will it work? Have we got it right? We decide on one more test.

With the receiver tuned to 20.054MHz, we set the input level to the cassette recorder so that the VU meter reads 0dB on the noise. Then we tune the receiver a megahertz lower, and then a megahertz higher. This causes the noise level to drop about 3dB each time. It indicates that our antenna is indeed resonant and most sensitive at 20MHz, the design frequency. It's nice to see electronic theory work exactly as predicted!

Grote Reber witnesses this test and announces "I think it's going to be OK". That's good; our rough and ready radio telescope has the approval of The Master.

7:59pm: We have the receiver tuned to the WWV time signal, and we start the cassette recorder. We intend to capture the exact 8:00pm time call as our time calibration mark. We will then switch over to 20.054MHz and continue recording for 45 minutes, one whole side of a C-90 cassette.

8:00pm: The WWV time call is safely recorded and we switch to radio astronomy mode. Check that both sides



"Let's pack up this stuff and get out of here!" Eric begins packing up the barbeque gear, while Grote takes a medicinal sip of Stone's Ginger Wine to fortify himself for the trip home. Dennistoun can get extremely cold...

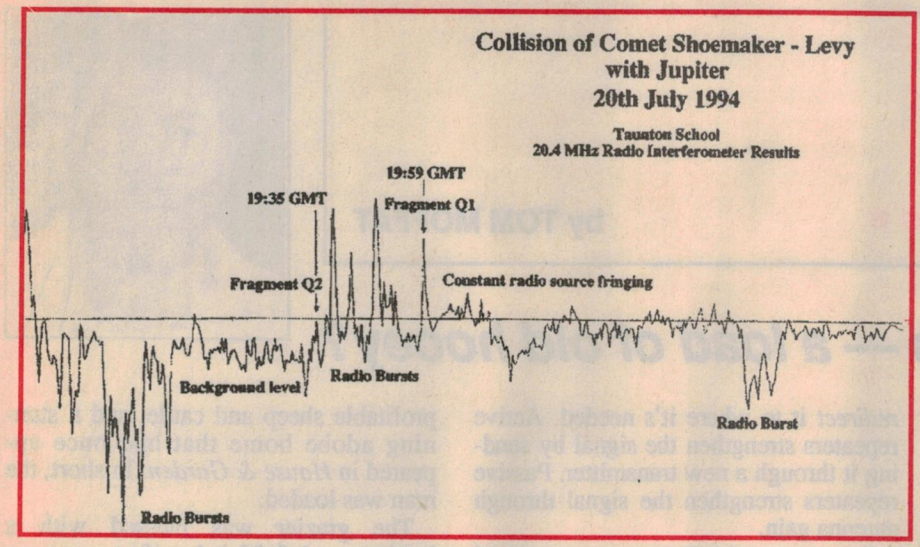


Fig.1: Found by Tom on the Internet, this chart shows a radio interferometer recording made by the Taunton School in England, on a frequency of 20.4MHz As you can see there is some evidence of signals from the Q1 and Q2 impacts.

of the antenna are connected to the balun; tune to 20.054MHz AM. Switch to manual gain control and ensure the RF gain is flat out. Set the cassette recording level for -10dB on the noise, so there will be plenty of dynamic range left should something really BIG happen when the comet hits Jupiter. Waiting... it's very cold. Eric is watching through his telescope.

8:08pm: This is the impact time announced by ABC news, but we see and hear nothing. The radio hiss is constant and unmoving.

8:17:32pm: Now it's one minute before the 'official' impact time for Fragment K. We think there may be a crackle coming from the radio. Could this be it? Or just our imagination? We tell Eric we're less than a minute from impact; start looking real hard!

8:18:32pm: IMPACT! What do you see, Eric? "Bugger all", he says. After the talking stops, it seems the crackling on the radio has stopped too. Was it there in the first place?

8:32:54pm: The comet impact site is predicted to rotate into view at this time. Eric sees no smoking ruin; in fact nothing at all. Everything appears normal on Jupiter. The radio noise continues with no changes...

I suggest we shut down and go home. But Grote says "No, no, keep recording!". He explains that we should get plenty of baseline data both before and after the expected event, so we can have something to compare it with. We keep recording until the tape runs out, and then Grote suggests we keep going on the other side of the cassette for a while.

9:00pm: Phooey. Nothing definite either seen or recorded. So we pack up all the gear and head for home. And just after we pass through Bothwell, having dropped off Grote Reber, the sky opens up and the rain comes down in buckets. I guess we tossed it in just in time...

The washup

Maybe the 5" optical telescope was just a bit on the light side. Something somewhat bigger, at the Mount Stromlo/Siding Spring observatory, captured the spectacular flash from Fragment K pictured herein. In fact big telescopes all over the world had a field day (field week?), so we've included a little art gallery of some of the more impressive images.

It's interesting to note that nearly every published image of the comet impact was taken in the infrared part of the spectrum. Maybe we didn't see anything because our eyeballs were tuned to the wrong frequency!

Back in Hobart, I played back our tape, starting a stop watch just as WWV announced eight o'clock. But as 8:17 and then 8:18 went past, there didn't seem to be anything out of the ordinary. What about the crackling? Well, it beats me. Maybe it was just imagination, or wishful thinking. But the tape hasn't been subjected to chart-recorder analysis yet...

Another radio astronomy attempt at Bruny Island by researchers from the University of Tasmania reported 'nothing of interest'. But students at Taunton School, at Somerset in England, may have had better luck. They were listening on 20.400MHz and they got some interesting results from Fragments A, H, and Q. They reported radio bursts beginning about an hour before impact, stronger bursts during the actual impact, and weaker emissions again for at least two hours after impact. The behaviour was the same for all three fragments. Taunton School's chart recording for the Q1 and Q2 fragments is shown in Fig.1.

The school was using heavy artillery: a phase-switched interferometer and two two-element Yagi antennas, each with its own 35-foot scaffold tower. The antenna had a total capture area of 60 square metres. Now *that* setup makes our effort, with one dipole and a stock-standard shortwave receiver, seem pretty puny. But what if there had been strong emissions from Jupiter? Maybe their system would have been overloaded, and we might have got the goods instead...

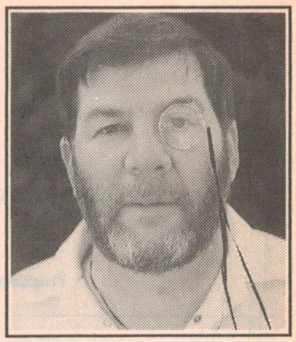
Our feeling was that no matter what happened, it was certainly worth having a go.

On the way back from Dennistoun, we were discussing the night's activities, and Grote Reber remembered that earlier in the day he had almost backed out. But now... "I'm glad we did this. If we hadn't done it, we'd be kicking ourselves for the rest of our lives, knowing we had the chance and didn't do it."

I'm glad we did it too. ❖

Moffat's Madhouse...

by TOM MOFFAT



Passive repeaters — a load of old hooey?

The hoary old subject of passive repeaters keeps raising its head, long after everyone has thought it's gone away. Never heard of passive repeaters? Well, you're about to, because the subject is again being argued in technical circles and in local and overseas magazines.

A *repeater* is simply a device that will allow a radio signal to be picked up and relayed into some area where coverage is not otherwise possible. This is done all the time; repeaters are very common in professional two-way radio services, and Australia is full of amateur VHF and UHF repeaters. They're also a way of life in CB. A repeater used on television signals is known as a *translator*.

A traditional repeater is a mini radio station established on a high place such as a mountaintop. There will be a receiver, with its antenna, and nearby a transmitter, with its antenna. The receiver picks up the desired signal, which is then broken down to audio (and/or video). This is run along cables to the transmitter, which rebroadcasts the signal again. Reception and transmission must take place on slightly different frequencies, otherwise the repeater would simply talk to itself. A traditional 'active' repeater of course requires electric power, either delivered up the mountain by power lines or supplied by a solar cell system.

A passive repeater, again installed on a high place, consists of the receiving antenna and the transmitting antenna, and nothing else other than some cable to tie them together. The signal simply comes in on one antenna and is squirted out through the other.

Now anybody with the least bit of technical knowledge will tell you that this won't work. Trouble is, the same people can prove that a bumblebee can't fly, but nobody's bothered to tell the bumblebee...

For a repeater to work it must do two things: it must *strengthen* the signal from a distant transmitter, and it must *redirect* it to where it's needed. Active repeaters strengthen the signal by sending it through a new transmitter. Passive repeaters strengthen the signal through antenna gain.

Say you would like to repeat a signal on 100MHz. A 100MHz Yagi antenna with 13dB gain is not out of the question. So you can use two of these antennas — one pointed at the source of the desired signal, and the other at the area you would like to relay the signal into. The feedpoints of the two antennas are then tied together with an appropriate transmission line, and you've got your passive repeater.

Let's add it up: 13dB for the receive antenna, and 13dB for the transmitting antenna, making 26dB of gain. The antennas will be mounted on the same mast, with their feedpoints tied together with perhaps two metres of something like good old TV twin-lead (very low-loss stuff!). Some signal will be lost through the transmission line and through the feed systems on both antennas, say 3dB. But that still leaves us with a GAIN of 23dB, which is a power increase of 200 times at the business end of the transmitting antenna.

Still won't work, you say? Well, here's a practical example.

It's time to re-live the adventures of Flubby the Wonder Technician. Remember him, in the Madhouse column a couple of years ago? Flubby was a man of few social graces, but he was a goldmine of electronic common sense. He was chief service honcho at the first electronics place I ever worked (a hifi shop in Albuquerque, New Mexico), and my mentor. You may also remember Jim, the sales manager of a somewhat prissy nature, but a top salesman nonetheless.

In a valley perhaps 60km south of Albuquerque lived a very rich grazier. He was a man of deep wisdom and conviction, a rough diamond who had worked his way up the social ladder to become one of the most respected men in the district. He now presided over many profitable sheep and cattle, and a stunning adobe home that had once appeared in *House & Garden*. In short, the man was loaded.

The grazier was blessed with a loving and faithful wife, a strong country woman very much like Australia's Sarah Henderson. She had stuck with her husband through all the hard times and now was sharing in the rewards. They both liked having beautiful things around them, and they both loved classical music.

One day the grazier came to town, wandered into the hifi shop, and Jim sold him an Ampex stereo. I'll bet you never knew the Ampex company was into consumer electronics, and as far as I know, this was their only consumer product. Its main feature of course was an Ampex tape recorder, but it also had a fine FM tuner, turntable, amplifiers and speakers, all in a hand-made walnut cabinet. The thing was priced at something like $3500, which was a fortune back then in the 1960's.

I think the Ampex stereo had been ordered mostly to enhance the prestige of the shop (or 'salon'), and it was never expected that anyone would actually buy it. When Jim closed the sale he was an instant hero. But — the sale was conditional on the stereo working properly on the grazier's favourite classical FM station. No FM, no sale!

One afternoon we delivered the stereo to the grazier's property (by moving van, it was so big!), along with a telescopic mast and a nice high-gain FM antenna. This was a total surprise for the wife, but she recognised quality when she saw it and instantly fell in love with the stereo. I want it RIGHT OVER HERE, she said.

Jim and I installed the antenna and then fired up the stereo for the smoke test. But on FM we got nothing but noise and mush — oh dear!

We rotated the antenna this way and that, and the nature of the mush changed (it was weak multipath reception) but it remained noisy mush. The grazier told

us to get the stereo out of there and give him his money back.

Jim went into diplomatic mode and sweet-talked the grazier into letting us have one more try at getting the FM to work. We retreated with our tails between our legs, but on the way back to town we saw other nearby houses with FM antennas on them — and sure enough, their tuners were working fine. But as for our man... well, there was this hill, you see, just in the wrong place, directly between him and the mountain which held the FM transmitter.

It was time to consult Flubby.

"Well, it's flubbin' obvious. The flubbin' hill's in the way, ain't it. You're going to need a flubbin' passive repeater!"

He explained what a flubbin' passive repeater was, and I commented that I didn't think it could possibly work. Flubby responded with something like "@!*%%flubbin'+&*!!". Anyway, he said it certainly *would* work.

Flubby rang Electronic Parts and a plumbing shop, and organised two big FM Yagi antennas, some good quality 300 ohm twin-lead, some guy wire and a six-metre length of water pipe for a mast. He told us to get the van and pick the stuff up (that pipe was a bit of a bother!), and go bung it up on that flubbin' mountain blocking the grazier's path to the FM transmitter.

Flubby himself wouldn't be going along. There were certain things that Flubby did and didn't do. He *did* spit on the floor, he *did* look at dirty pictures, but he *didn't* Climb Flubbin' Mountains. It turned out that Jim didn't climb flubbin' mountains very well either, but he didn't realise it until he tried...

Boy it was hot. That hill was like so many in New Mexico, it rose abruptly out of the flat desert, climbing steeply to dizzying heights. So we could drive the van right to the base of it before starting to walk. We tied the two antennas and all the other bits and pieces along the centre of the length of water pipe. Then I got at the front and Jim got at the back and we raised the pipe to our shoulders, like a couple of hunters carrying a slain beast through the African bush.

This worked great until we started climbing. Then all the goodies slid along the pipe right down onto Jim, flattening him. He hit the ground screaming and then yelled "Rattlesnake! Rattlesnake!" — and sure enough, he had landed right next to a snake that had been quietly sunning itself. The snake was not impressed; it was going to be one of those days...

We lashed the load onto the pipe again, and this time Jim took the lead. Pity, I thought I'd conned him into taking the heavy end, the end furthest downhill. But since he was now in the lead, Jim was the first to meet further opposition. So up we struggled, with occasional shrieks of "Rattlesnake! Rattlesnake!".

In fact the snake population almost convinced Jim that the passive repeater wasn't such a good idea. But I kept reminding him of all that yummy commission on the Ampex stereo, and how he would be in the poo if such a big sale fell through. We kept climbing.

It took over two hours, but we finally made the top. And there below us was the grazier's homestead, sparkling in the sun. Behind us, the lofty summit of Sandia Crest, and it was so clear we could see the transmitting towers even 60km distant.

So we huffed and puffed and put all the stuff together as per Flubby's careful instructions — one antenna pointing towards the Crest, the other towards the grazier. Then we used rocks as sledgehamers to pound some stakes into the dirt to use as anchors for the guy wires. And then we huffed and puffed some more and got the whole works vertical. With the guy wires secured, the pole looked like it was going to stay up all right, so we headed down to the homestead to try out Flubby's Folly.

Compared to the trip up, the trip down was a piece of cake. We had just a few tools to carry, so we fairly scampered along, with only occasional shrieks of "Rattlesnake! Rattlesnake!"

Jim was so glad to see that car. And I'll let you in on a secret: I was too.

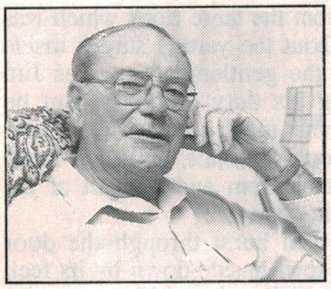
We raced back to the homestead and re-aligned our first FM antenna so it was pointing at the new passive repeater — we could see it clearly on top of the hill. Then we went inside and fired up the stereo's FM tuner. And out of it poured forth what seemed the sweetest music I'd ever heard. The signal strength indicator was hard over on full strength and there wasn't a sign of noise or distortion. It was absolutely superb — just as good as in the showroom back in the city.

Needless to say, the sale was back on again. The grazier was so happy he invited us to stay for dinner, an offer which was gladly taken up. But, on this old property, things were done the way they'd been done for generations. Dinner was kept 'on the hoof' until the moment it was needed; what manufacturers today would call 'just in time delivery'.

So the grazier gave Jim a .22 pistol and told him to go outside, to shoot a chicken from the large flock which was running about the yard. I stayed inside sampling the gentleman's rum as Jim was doing his duty outdoors. But he wasn't having much success. We'd hear an occasional gunshot, and then nothing, and then from another part of the yard, another bang.

Finally Jim burst through the door holding a fowl upside-down by its feet. "I've done it! I've done it!"

Jim was feeling very macho, and proud. But the grazier had other thoughts: "You've done it, all right! You've gone and shot the damn rooster!" ❖



When I Think Back...

by Neville Williams

Stromberg-Carlson, Admiral and the battle they both lost — 2

In the mid fifties, anticipating the introduction of television broadcasting, America's Admiral Corporation set out to capture a share of the Australian TV Market. They produced a lot of monochrome receivers, only to disappear from the local scene a few years later. This second instalment begins with the development and launch of the Australian-made Admiral TV range.

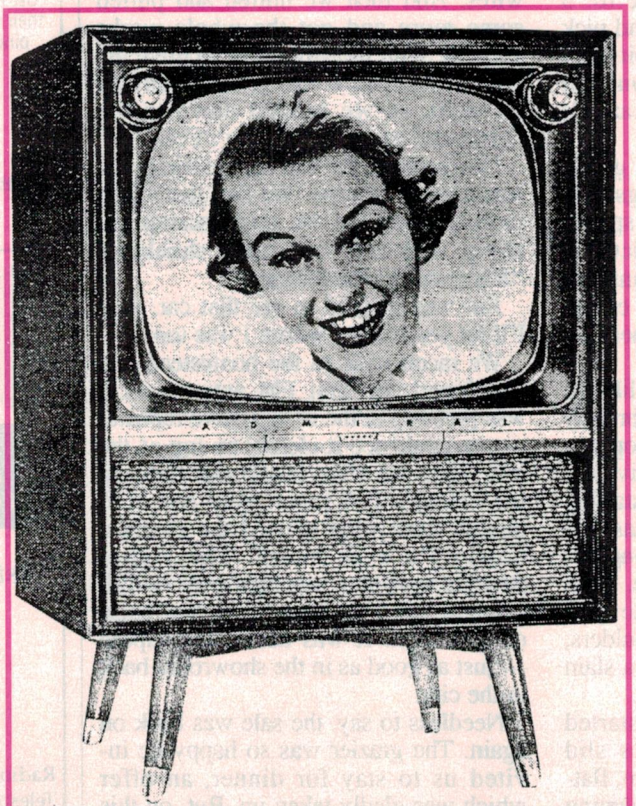
In last month's article, Fred Hawkins of Castle Hill in NSW told how, after job training in the Stromberg-Carlson factory, he became only the fourth employee of the newly formed Admiral of Australia, Pty Ltd. Headed up by the late Eric Fanker, ex Thom & Smith/Tasma, Admiral had been set up on the mezzanine floor of the old General Industries Refrigerator Factory at Waterloo, Sydney, pending the construction of a new factory in the Bankstown area.

Fred's initial assignment had been to develop a range of radio receivers, primarily to give the Admiral tradename exposure on the local market. But this arrangement came unstuck, when an ex-AWA TV-trained engineer resigned after a confrontation with Eric Fanker.

Another technician 'imported' from Tasma was put in charge of the radio receivers, leaving Fred Hawkins to coordinate the TV project under the guidance of Eric Fanker — himself an experienced electronics engineer.

The plan was to develop an Australian version of the American Admiral 20Y4 chassis — a new 20-valve unit on a single vertical chassis, supporting the relevant power supplies, etc., plus printed circuit boards carrying the IF system, audio and sync separator. A large hole in the centre of the chassis accommodated the tube yoke. The VHF turret tuner was mounted on an outrigger from one top corner, while the volume/contrast controls were also concentric and operated by cables such that two sets of dual-concentric knobs (channel selector/fine tune and volume/contrast) protruded through the top corners of the safety glass. As such, I gather, they gave Admiral TV sets a distinctive 'two-eyed' appearance.

The auxiliary controls were fitted with long plastic extension rods, accessible behind a drop-down metal flap beneath the picture tube (the 'mouth'?).



The only illustration we could find of one of the original Admiral TV receivers is this one from the September 1956 'House & Garden', of a 'Miami' model. Described as an attractive TV console, it had a swivel base and cost 229 guineas. The minor controls were behind a drop-down aluminium panel below the screen.

Eminently 'buildable'

Fred Hawkins says that the chassis and picture tube mounting of the 20Y4 involved clever bracket-work, with a gold escutcheon that allowed considerable flexibility in cabinet design. The end result, according to Fred, was a more professional presentation than anything else on the American market at the time.

The designers had also managed to engineer the mechanical components such that they could accommodate both 21-inch and 24-inch picture tubes, unwittingly adding insult to injury for other Australian firms committed to their obsolescent long-necked 17-inch picture tubes.

Circuit-wise, the basic 20Y4 turned out to be an adequate performer, with the colour temperature of the mono screen a little bluer than its peers, by reason of the phosphor selected by the picture tube suppliers — Thomas.

The one questionable aspect of the design was in the sound

department, where 'stacking' of the B-plus line limited the effective audio HT supply to about 120V, and the power output to about one watt. (A copy of the equivalent Australian circuit, supplied by Jim Yalden, shows the plate/screen voltage of the audio output tube as 265V but the cathode line, which disappears into the rest of the circuitry, sits at 150V).

On the credit side, says Fred, the stacking technique made for an economical power supply, reflected in reduced bulk, weight and cost. With his production background, he judged the 20Y4 to be an eminently 'buildable' design; and so it turned out to be in practice.

Admiral USA assigned the Australian factory the model number AX20Y4 for their proposed version, and supplied drawings of the original 20Y4 plus two sample receivers (110V, 60Hz and USA TV standards). For the rest, the Australian factory would be 'on its own', although the US company would be prepared to help out, if necessary.

Query regarding IF

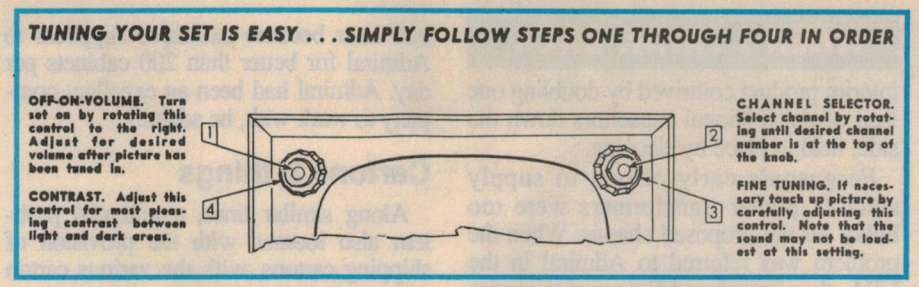
However, right at the outset, the American engineers queried the intermediate frequency designated for Australian receivers. They pointed out that it bore a mathematical relationship to the frequency allocated to our Channel 2, which could result in herringbone interference.

They suggested that Admiral of Australia should alert the relevant authorities and the industry to the potential problem — and, says Fred, that's exactly what Eric Fanker set out to do. But to no avail. They didn't want to know about it. Who were these critics anyway? Australian experts had solemnly debated and settled upon 36MHz, and that's the way it was going to remain!

Rather than take the risk, Admiral Australia decided to stay with their nominal 21MHz IF channel. My former assistant Phil Watson reminded me that American TV receivers had suffered interference from CB (Citizens Band) transmissions in that country, and were themselves planning a change. But no such problem loomed in Australia where, at the time, CB was a dirty two-letter word!

How different is all this from the accounts circulated in the 1950's, where Admiral of Australia were depicted as off-shore intruders putting buyers at possible risk by ignoring formal guidelines spelled out by Australia's technical cogniscenti!

In conversation, Fred Hawkins claimed that American Admiral's prediction came true and there was, indeed, considerable



From the Owner's Manual of an original Admiral TV receiver, showing the role of the twin concentric controls. (By courtesy of John Wallace, Gorokan, NSW),

consternation when the herringbone patterns appeared, resulting in a lot of belated intermediate frequency 'nudging'!

At this point, I rang engineer A.N. (Neville) Thiele, who was talking about the phase linearity of TV IF channels at a time when most of us were having difficulty enough coping with frequency response. Did *he* remember herringbone effects involving Channel 2?

Plenty of discussion

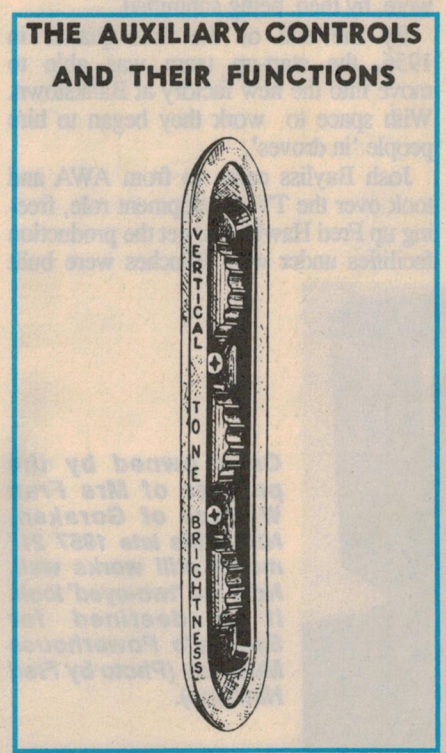
Neville couldn't recall the details, but said that there had been interference problems in the early days — attributed to a variety of situations, ranging from the combination of signals in particular reception areas, to the IF response of particular receivers, and excessive radiation from the video detector circuitry in others.

It was all too long ago to recall the details. But while he agreed that there had been considerable discussion and frequency nudging, not all of it would have been attributable to Channel 2, as possibly assumed by Fred Hawkins. In his own company (EMI), Neville said, they had positioned the picture IF carrier on 36.875MHz — a figure he remembered because it was commonly referred to as 'thirty-six and seven- eighths'!

Be that as it may, Fred Hawkins said that Eric Fanker was furious about the way his peers affected disinterest in what he and his co-founders were saying and doing. They seemingly ignored prior warnings that Admiral planned to launch with state-of-the-art technology: 21 and 24-inch picture tubes with 90° deflection, short necks and slimmer cabinets. They reassured one another with the old adage: "Let's learn to crawl before we walk"!

They refused to accept Admiral as a legitimate competitor, committed to building a large, modern factory, and also that Thomas (which also began as an offshoot of a US firm) was doing the same thing at nearby Riverwood to manufacture picture tubes. When Fred Hawkins mentioned Admiral's plans to his former workmates at Stromberg-Carlson, he says "They considered our proposed target of 200 sets a day as hilarious!"

They would not concede that Admiral posed any real threat to the established industry, pushing the line that Australian customers would support the brands they knew, rather than one they had never heard of!



From the Owner's Manual of an Admiral TV receiver of around 1957, showing the side-mounted thumbwheel minor controls. (From John Wallace, Gorakan, NSW).

Press on, regardless

So Admiral did the only thing they *could* do — forging ahead and establishing links with component suppliers. Their stated aim was to commence production with a local content as high as possible, with the objective of 100% within two years.

Capacitors designed for printed circuit board mounting were virtually unknown in Australia at the time, so Admiral supplied local manufacturers Ducon and UCC with samples. While planning to add them to their range, they came up with an

interim product contrived by doubling one lead of conventional capacitors down the side, held in place by sleeving.

Ferguson's early efforts to supply suitable power transformers were too bulky for the proposed chassis. When the problem was referred to Admiral in the USA, they introduced Ferguson to grades of stalloy that they had previously only dreamed about, and helped them to arrange supply.

Cabinets, too, posed a problem, with most of the established manufacturers fully extended by the production of radiograms and their committments to other Australian set-builders.

So Admiral did the rounds of furniture manufacturers — but no one company could undertake quantities to match Admiral's projected requirements. The idea of settling for multiple suppliers was complicated by the fact that the firms were set up for different fabrication methods. Some were using three-ply on wooden frames, others heavy ply without frames. None was designed to withstand the internal heat generated by a TV chassis. Ultimately, Admiral secured the cooperation of three manufacturers — including Everett Worthington — who were prepared to produce suitably designed cabinets. To spread the load, Admiral took a stab at the projected sales of three anticipated models and allocated one model to each firm to match their likely capacity. Even so, says Fred Hawkins, "If anything was going to go wrong, it would be cabinet supply!"

(Bill Culbert, who with Brian Peters was a joint owner of Everett-Worthington in the 1950's, told me by phone that they had later become exclusive suppliers to Admiral for better than 200 cabinets per day. Admiral had been an excellent company to work with, he added.)

Cartons & things

Along similar lines, a potential problem also loomed with the provision of shipping cartons, with the various carton makers living in the present with no thought whatever of the soon-to-emerge television industry. It took a lot of talking to convince them that Admiral was serious; but after the injection of new capital, they were again able to line up three initial suppliers — to spread the risk!

It was decided at the outset that tuners, yokes and horizontal output transformers would be sourced from Standard Coil in the USA, and Eric Fanker attended to this personally with the help of American Admiral. The projected quantities presented no problem.

By the end of 1955, Admiral Australia had decided that, for the time being, they would retain the American IF system and, on that basis, built two prototypes of their new AX20Y4 conforming in other respects to Australian standards. One was sent to the USA for evaluation and the other retained for test installation in the various cabinets that were, by then, being submitted.

By the end of the first quarter in 1956, the start-up team was able to move into the new factory at Bankstown. With space to work they began to hire people 'in droves'.

Josh Bayliss came in from AWA and took over the TV development role, freeing up Fred Hawkins to get the production facilities under way. Benches were built and the associated equipment installed, after which came the job of interviewing prospective staff.

Eric Fanker and John Clarkson, the Managing Director of parent company General Industries, worked long and hard to set up Sales, Purchasing, Production Control, Despatch and Service. There was no shortage of applicants, many of them from Tasma, who knew one another and understood beforehand the relationships and procedures appropriate to an electronics factory. "We all worked together — it was a fantastic year!"

Guiding principle

Fred Hawkins says that, at the outset, he and Eric Fanker had agreed on a guiding principle for receiver production: "Mean-time-to-failure should take priority over mean-time-to-fix." Translated into plainspeak, it meant that components and constructional methods should be chosen to minimise the risk of failure, rather than the time taken to repair. In accordance with this, joints would be wrapped first before soldering. Yes, it was tedious. Of the 20 operators on each of the two final assembly lines, 18 would wrap joints. When the set was complete and checked for accuracy, two specialists would solder them.

The short-term reward was gratifying: "It was unknown for an Admiral AX20Y4 to fail as the result of a dry joint". The less fortunate fall-out was to come later!

By the end of August 1956, thousands of receivers had come off the production lines and had been performance checked on a low power TV transmitter installed in the building. There was much excitement when Channel 9's first still pictures appeared on air, and even greater excitement when they transmitted *Treasure Island* (or was it *Robinson Crusoe*?) — even though it failed in the middle.

I quote Fred here: "By opening night, there were Admiral sets in dealers' windows all over Sydney, and the production line (at Bankstown) was running flat out".

"All told, that first year was little short of a miracle for us. Virtually nothing went wrong. Fanker was busy filling out the organisation. He was now able to get the best people and he paid them well."

"He was working towards making our own tuners, yokes and horizontal output transformers. He was looking at automating the printed circuit assembly."

"I was now managing chassis assembly and testing, with the objective of pushing production to the 200 per day target. We made it on odd days during the first year, and it became consistently achievable in the second year."

Once owned by the parents of Mrs Fran Wallace of Gorakan, NSW, this late 1957 21" model still works well. Note the 'two-eyed' look. It is destined for Sydney's Powerhouse Museum. (Photo by Fred Hawkins).

Startling figures

Fred Hawkins continues: "On the first anniversary of the start-up of TV, management revealed the company's position to the staff and we learned that, although there some 19 players in the TV manufacturing game, we had achieved 85% of the sales!"

"Further, we had been able to remit a handsome first-year profit (I seem to recall it was about one million pounds) to our joint parents, General Industries and the Admiral Corporation."

"On the other hand, our competitors were in confusion. Their 17-inch sets (at the same price as our 21-inch models) looked positively puny by comparison in the shops."

Fred says that it was about this time that the hassles about the choice of IF came to a head. As far as the public was concerned, Admiral had been painted as the 'bad guys' but it was the established brands that suffered herringbone interference — for whatever reason. The roles had now been switched, and it was the one-time good guys who were in trouble — with post-mortems and the IF nudging mentioned earlier.

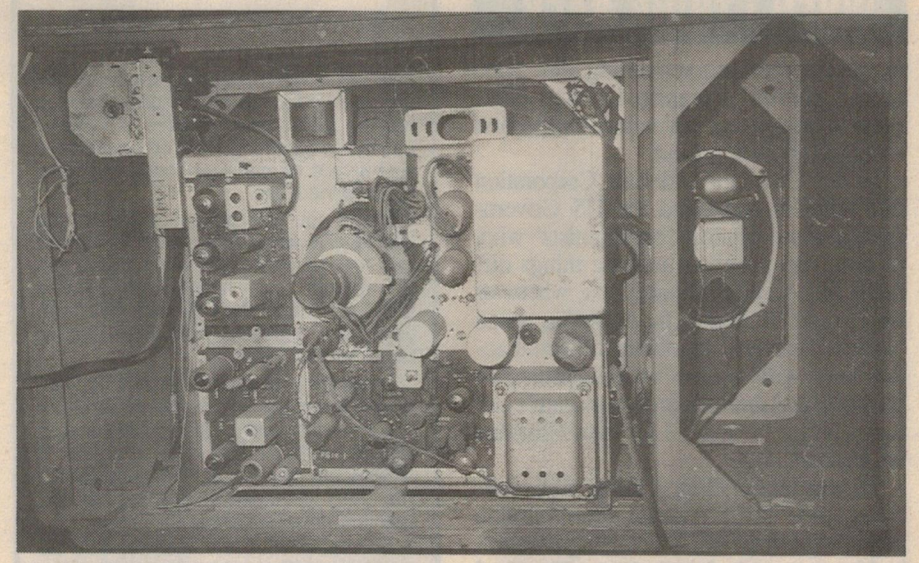
But Admiral Australia was not in the clear, either, for a quite different reason. American manufacturers were in the throws of abandoning their 21MHz IF standard, partly to dodge CB interference and partly to adopt a new figure around 40MHz as being more appropriate for VHF/UHF TV services.

Admiral Australia had been tooling up to produce their own version of the American tuner, convertible to a 30MHz IF. Should they simply persist with an imported tuner and an IF that was fated to become an orphan in the forseeable future, or repeat the whole exercise and follow the Americans up to 40MHz? Or use the occasion to switch to 30MHz — in the hope that the local standard would have been tweaked sufficiently to overcome their earlier objections?

Having stated Admiral's intention to come into line with Australian Standards at the first opportunity, Fanker decided that the time had come. But their tuner wasn't ready. Fortunately, Philips tuners were available and could be used in the interim by fitting them with extension shafts — which Admiral was able to do.

Through the glass

A tedium for the whole industry at the time was the perceived need to safeguard householders from flying glass, in the event of the picture tube 'imploding' as the result of mishandling or bumping. Modern tubes are much less vulnerable but, in the 1950's, it was mandatory to cover the screen with a sheet of laminated or armoured safety glass.



A rear view of the late 1957 Admiral receiver pictured elsewhere. Note the printed circuit boards, and the tuner attached to a bracket at the top left hand corner of the vertical chassis. (Photo by Fred Hawkins).

In the late 1950's, virtually all Australian TV manufacturers sourced their safely glass, directly or otherwise, from Pilkingtons in the UK. Unfortunately, the supply was suddenly interrupted, presumably due to industrial trouble. Local TV set-makers were in deep trouble, particularly those who were working 'hand-to-mouth' (of necessity) or 'just-in-time' (by choice).

Once again, Admiral came out on top. Because they needed clearance holes for their dual-concentric controls, they had to place large orders, early, to get the holes cut at the glassworks. As it happened, Admiral had sufficient glass on hand to maintain production while many of their competitors ground to a halt.

But there had to be an end to their unique flying start. Fred Hawkins says that, inevitably, other manufacturers 'got their act together' — particularly Stromberg-Carlson and Kriesler, and came up with 21-inch models. What's more, they homed in on superior sound, exploiting Admiral's vulnerability in this area.

Updated models

The time had clearly arrived to update their successful 1955 designs. In the shorter term, the now somewhat tired two-eyed look was softened by different knobs. Table model TV cabinets were further restyled with rounded corners, vacuum formed from one-piece seven ply. Planning also began to follow the parent factory into 110° deflection picture tubes, with a new company decal and a totally different layout of controls.

Two new models were announced incorporating a record changer, manufactured by the Lithgow (NSW) Small Arms factory to a design by the Admiral Corporation. One of these shared the TV audio system; the other incorporated a radio receiver with a push-pull audio amplifier, offering 'a quite presentable performance'.

They also made a tentative move into stereo radiograms, using a simple — if somewhat gimmicky — circuit attributed to American *Electronics* magazine.

Their one mistake, it seems, was to add two lightweight 'portable' TV sets to their range. Using a 'hot' (transformerless) chassis in a two-tone painted metal cabinet, one had a 14" screen, the other 17". Unique in the market, they failed to find a niche. They also proved to be the one troublesome item in the Admiral of Australia range, tending to tarnish, be less than reliable and nasty to service!

They underscored growing unrest in the engineering team. Fred Hawkins says that it was an uncomfortable period which 'continued for too long' and ended only when Allan Scott left Stromberg-Carlson and joined Admiral as a specialist Chief Engineer.

It was very much a case of Stromberg's loss becoming Admiral's gain, and probably coincided with Les Bean's re-involvement in the daily running of Stromberg-Carlson.

The 'honeymoon' ends

But quite suddenly, says Fred Hawkins, the marketing honeymoon was over! Demand began to slacken off and Admiral's stock of finished TV sets, radiograms and mantel radios began to ac-

cumulate, totalling something like 5000 units. Admiral's management couldn't quite believe it and maintained production — until fate took a hand.

In the USA, the Admiral Corporation had actively supported the US Government's move against 'communists' who, in turn, had set about making things difficult for Admiral connections, wherever they could be found. In Australia, union 'stirrers' managed to initiate industrial action to do with 'unsafe' working tools (see panel). But Admiral's problems didn't end there, and it is best if I let Fred Hawkins tell his own story:

"It was late in 1958, I think, when Admiral made its big mistake. From humble beginnings, the H.G. Palmer organisation had become part of the industry. They had done so by heavy advertising of irresistable deals, complete with a maintenance insurance policy from their own service company and finance from their own finance arm."

"They had a central service and administrative complex at the corner of Canterbury and Chapel roads (Bankstown), and a branch shop in every major suburb and town. At the time, the price of a 21" table model was 219 guineas ($481.80), the equivalent of around $6500 in today's values — a significant purchase decision. A console was 239 guineas. The cheapest 'unbranded' set ('Southern Cross' or 'Precedent' 17") was 169 guineas. This was the type of set HG's had been pushing."

"Now they wanted to go up-market, and accordingly proposed a deal to Admiral: They would take a guaranteed number of sets (about half Admiral's production), and they would get them at a very low price. Admiral needed only to truck them around the corner to HG's warehouse and they would do the rest. Admiral accepted the deal."

"Palmers started to advertise Admiral in a big way. Business regulations in those days forbad advertising major discounts, but Palmers evaded them by offering to trade in anything of little (or no) value on a TV set."

"Normal dealer discounts at the time were about 30%, and a good talker might win 10% off the retail price. It was evident, however, that HG's were offering sets for little more than a normal dealer had to pay in the first place. So dealers deserted Admiral, and began to promote other brands."

"Worse still, HG's discounting diminished the image of Admiral but HG didn't or wouldn't accept unbranded sets. They needed the credibility of what had been a big-name supplier. It was an uncomfortable situation, but Admiral got by for a while on the strength of sets still sold on normal margins."

"By then, Stromberg-Carslon had commissioned their conveyer belt assembly line and had a production facility much greater than their normal sales could support, and they duly made H.G. Palmer a counter offer."

"Presumably there wasn't much to it in terms of price, but Strombergs were able to demonstrate that their chassis was easier to service than the Admiral. It was capable of being withdrawn from the cabinet in half the time, and the components were easier to replace (no twisted leads!). Strombergs got the deal, leaving Admiral out in the cold; but pretty soon, another company outbid Strombergs!"

"Then in 1957 - 8 came a major credit squeeze. Dealers found it difficult to finance their potential customers, and repossessions became the order of the day. Many crashed, as did H.G. Palmer and their imitators."

"Stromberg-Carlson and Admiral both finished up with far greater production capacity than their residual market share could support. There was no scope for badge engineering and little hope of wooing back disenchanted dealers and customers. What's more, the market that remained had become selective, conservative — and turned to Pye, Kriesler, Philips and AWA, with traditional names and 'walnut' cabinets.

"Looking ahead, Admiral Australia's parent companies could see no light at the end of the tunnel. Colour was a long way off and the Japanese would be in the act by then, anyway. Besides that, the factory was valuable in its own right — the more so when their refrigerator factory next door burned down."

"In the case of Strombergs, the banks were getting restless."

Fred Hawkins concludes:

"Australia was just getting its first computers. To me, it seemed like a good time to change careers and get in on the ground floor. A lot of people did so."

"I jumped the gun and left Admiral at the end of July 1958, to join IBM where I stayed for 31 years — the rest of my working life."

"I am not sure when the doors closed for the last time at either Stromerg-Carlson or Admiral, but it was very early in the 1960's.

"That's the way I remember it, when I think back!"

Thanks, Fred, for a story that might otherwise have remained untold — submitted in text that befits your 31 subsequent years at IBM! ❖

It's not cricket, brothers!

When fitting picture tubes into Admiral's cabinets, it was necessary to use a lever of some kind to elevate the tube while the holding bolts were installed. The lever needed to be strong, tapered and springy — but not of metal, in case it should damage the glass.

Some genius suggested that the handle of a cricket bat should fill the bill, and so it did. Better still, Admiral managed to organise a supply of handles from a bat manufacturer and they were used over a period to fit thousands of tubes, without incident.

Looking for a cause, union 'stirrers' fastened upon the bat handles: Admiral management was requiring unionists to perform work, but had failed to provide a professional tool custom designed for the job. They managed to pull out half the staff in a strike that lasted six weeks.

Normal production ceased, but the remaining staff was kept busy with maintenance around the factory, fixing faulty sets that had been off-loaded from the assembly line etc., and building new product samples.

At the end of six weeks, the entire surplus and dead stock had been cleared, the strikers had lost six weeks' pay and were duly ordered back to work — using the cricket bat handles as before!

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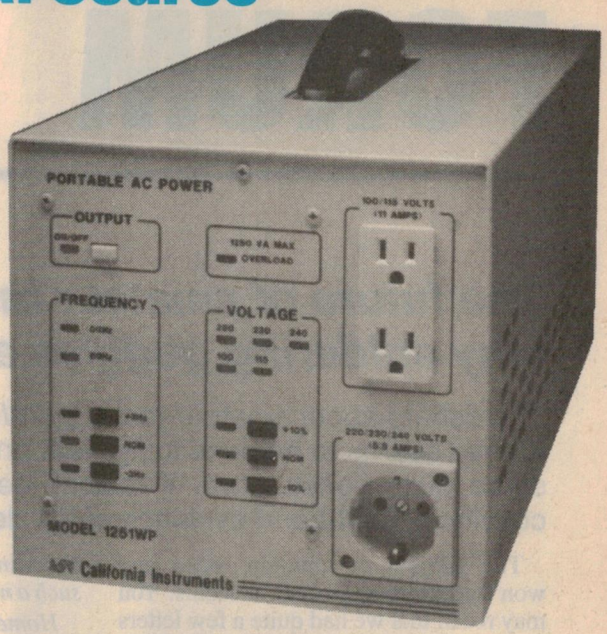

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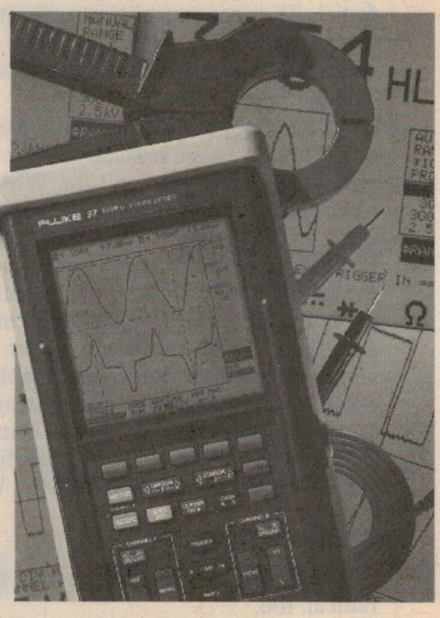

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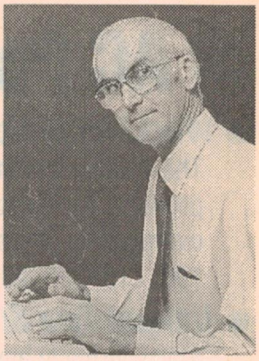


The future of amateur radio, and why soldering goggles are worthwhile...

The debate about amateur radio, the Wireless Institute of Australia and their respective long-terms futures seems to be continuing, with an interesting twist: people are now starting to come up with some quite constructive, if radical ideas. I also have an interesting letter from a reader with convincing first-hand evidence of the desirability of wearing eye protection while you're soldering.

The subject of amateur radio just won't go away at present, it seems. You may recall that we had quite a few letters on the subject following Tom Moffat's column in November last year, broaching the subject of unpleasant behaviour on the bands. Then there was another, even bigger response following my publication in May's Forum of the letter from a long-time amateur and WIA member using the *non-de-plume* 'An old fogie'. That one must have *really* stirred things up, in fact, because since then we've had a fairly steady stream of letters and faxes.

It's been noticeable that while the first crop of letters were basically rather critical of radio amateurs and the WIA, the more recent letters have been defending them — in particular from the criticisms levelled by our 'old fogie'. And although the letters I have for you this month are along the latter lines, yet another emphasis seems to be emerging: rather than simply defend the *status quo*, people are now starting to suggest either ways in which amateur radio can improve its image, or viability, and/or ways to fix up some of the problems besetting the WIA.

Radical ideas...

Some of the suggestions are fairly radical, too.

Anyway, here's the first of the letters concerned, which comes from Norm McMillan VK2XCI, of Mount Hope in NSW. In a small post script, Norm admits it was written in some haste, and with a certain amount of anger; but nevertheless he makes some interesting suggestions, as you can see:

A few words, if I may, on the subject of Amateur Radio. Having just read Drew Diamond's letter in July '94, I was prompted to re-read the original missive from 'Old Fogie'. I sincerely hope that there are not too many hams around with such a negative view of our hobby as 'OF'!

Home building died out? I don't think so! Sure, not many hams build their own transceivers nowadays. It's just not viable or even possible to build to the standard of commercial gear. However a quick look around my own shack, and conversation with other hams seems to indicate about 50/50 commercial to home-brew gear. Power supplies seem to be the most common home brew item, followed by antennae, various kitset items and modified commercial gear. Perhaps 'OF' is guilty of judging others by his own standards!

Achievements

As for amateur radio being an anachronism! Does 'OF' not realise that hams are at the forefront of many technical endeavors? AMSAT, for instance, is leading the world in the design and launching of small, efficient and affordable satellites, and they were able to show such an august body as the European Space Agency how they could better utilise the available payload space on the Arianne launcher.

What about EME, packet radio, SAREX, aircraft enhanced propagation? All leading edge stuff! I for one can't find enough time to try all the things I want to do. How about some 'Field Day' style operating? A real challenge, especially on V/UHF! If 'OF' doesn't have his head in the sand, then it's surely in a bucket of something far less pleasant. Pack up your HF gear, 'OF', and move up the bands a bit. I think you'll find the Spirit of Ham Radio really is alive and well, and grows stronger as the frequency gets higher.

The Wireless Institute is far from superfluous. It is important that we have some sort of representative body to look after our interests, in view of the commercial nature of the SMA. Does 'OF' really believe that the WIA has achieved nothing '...that wouldn't have happened anyway'? That sort of attitude is EXACTLY what brings organizations down. Believe me, nothing will happen unless you make it happen. Who was it that won allocations in the SHF and microwave bands for satellite links? And that in the face of stern French opposition.

Instead of asking what the WIA can do for you, ask what you can do for the WIA (to paraphrase a great man). They sure could use the help!

As for the current unsavoury activities in the NSW Division, they are simply a mirror of our own State and Federal Parliaments. Nothing of any merit is born without some pain. We should look forward to a brighter future with a WIA more responsive to members' wishes, rather than the '...particularly bleak...' one that OF prophesies. The WIA must continue in some form if we are to have a future.

So, What IS the future of Amateur Radio? The future, mate, is exactly what you make it — no more, no less! It's no use sitting on your bum waiting for someone to give it to you! If your vision is one of private service providers, then you deserve what you get.

Different vision

I too have a vision, 'OF'; let me share it with you!

I see a single national body, rather than the collection of State 'clubs' that we have now. Something perhaps after the fashion of the NRMA (haven't THEY done well!), with a professional board of management and professional lobbyists in Canberra. This may grow from, or in spite of the WIA. The magazine, be it AR or something quite new, will be produced

profitably by a professional publisher funded solely by advertising and sales. The members' funds can then be used where they can do most good, i.e., representing the members' interests at national and international level.

This body will have representatives on the various committees that have direct input to the regulating authority, be it the SMA or whatever. The licensing system will change to allow for those who simply want to communicate and those who wish to experiment, with classes based on technical knowledge rather than the ability to read the Morse code. (That'll stir up a few!) The representative body will set the standards and issue the licence, under guidelines developed with and laid down by the regulating authority.

Technically, I see more development of the currently disparate packet network into a truly national network, eventually into a true wide area network, rather than the collection of BBS's and mailboxes we have now. Eventually, there will be a rationalisation of BBS's as the speed and reliability of the network improves. A National VHF/UHF voice repeater link-up will be developed using 'digital concentration' techniques similar to Telecoms rural telephone service. These systems will probably be implemented using a phase-four geostationary satellite rather than terrestrial links. There will be more use of the SHF and microwave allocations as equipment and knowledge improves.

Pretty radical ideas I know, but at least I can see the way I want to go. Remember, the future is what you make it! Instead of bleating and wailing, do something positive. You may find a surprising amount of support.

Thanks for those comments, Norm, and I believe you've done a good job of presenting the positive side of the case. At the same time, you've quietly done your share of 'stirring' too, in your own 'vision statement'. That bit about changing the licensing to remove the Morse requirement, and basing grades on technical knowledge, has probably given some of the more conservative/elitist hams apoplexy already — quite apart from the proposal to have the WIA (or its successor) issue licences, and to have *Amateur Radio* turned into a fully commercial publication...

It's interesting that our next letter raises a number of very similar suggestions — perhaps the people concerned have been preparing notes, or are at least thinking along similar lines.

Actually the next letter appears to be something of a 'general circulation' missive, rather than one directed to *EA* and Forum alone. It comes on the letterhead of the Lower Eyre Peninsula Amateur Radio Club, Inc., of Port Lincoln in South Australia, and is also addressed to 'All Australian Radio Clubs, WIA Federal and State Branches, and *Amateur Radio* magazine.

The author is J.J. Martin, VK5EJ, President of the LEPARC, and the suggestions he makes on behalf of his club are also fairly radical. The letter is headed ***LET'S TAKE AN OBJECTIVE AND CONSTRUCTIVE VIEW OF THE WIRELESS INSTITUTE OF AUSTRALIA***, and then proceeds thus:

Our club, the Lower Eyre Peninsula Amateur Radio Club Inc., located at Port Lincoln in South Australia, is geographically isolated from the main stream of amateur radio activities.

We are, however, all members of the WIA, because we believe that the pressures of frequency allocation, in a world which relies so heavily on communication, will, if we are not vigilant and strong, allow other services to infiltrate into our bands.

We see evidence of this already with the intrusion of powerful stations from

many countries, which are daily invading our frequency allocations. Let's do something, now, to stop this from proliferating to the point where we may not have exclusive use of ANY band!

Firstly, let us strengthen our official body, the WIA, which is already RECOGNISED and RESPECTED by the SMA. Our club has recorded the following thoughts for your consideration:

1. As the Institute is the voice of Australian amateurs with the Spectrum Management Authority and other Government Authorities, we propose that the WIA becomes the Authority authorised by the SMA to collect licence fees from amateur operators and to act as the coordinator for all relevant matters.

2. That the licence fee and the Institute membership fee be collected on the one account. The administration costs would thereby be substantially reduced, thus reducing the overall cost to the amateur.

3. This would substantially increase our representation with the SMA, as the Institute would be representing ALL of the amateurs, not below 50% of them as at present.

4. That the Institute magazine 'AMATEUR RADIO' be placed on public sale through newsagents. Any problems with taxation could be overcome. This will attract additional advertising and would have a beneficial effect in attracting recruits to our pastime.

5. We further believe that the State branches (divisions) of the Institute are not being administered to the benefit of all members in that state.

As individual members of the WIA, we each pay a membership fee to the Institute. Our club pays an affiliation (membership) fee to the Institute. Because our club has expenses such as light, power, etc., we each pay an additional club membership fee. Because of the distance, we do not have access to the facilities which are available to the member and, almost certainly, non-member who lives close to the state 'headquarters'. We would feel much happier if we knew that the members who enjoy the facilities of the Barley Griffin Building in SA also paid a fee for that privilege. A perusal of the division's accounts seems to indicate that the B.G.B. expenses may be being paid for by all members.

We believe that the management of the Institute should continue in each state, with a state committee, but that this committee consist of a member from each local radio club plus other members with special knowledge or with useful contacts in the right places. This state body would then elect the federal councillor for that state. Meetings could be held bi-monthly.

This system is already in place in respect to the relationship between the state bodies and the federal body, with the states each providing a federal councillor.

6. That in this age of digital communication, we should be considering altering the requirement for a full call, to add as an alternative to Morse, that a qualification in digital techniques be an acceptable requirement. The HF bands are not being inhabited nearly enough and the reasons could well include a lack of interest in Morse, which most operators will never use. It is our opinion that the Morse requirement which obviously had value years ago is now of no real value and if a barrier is required, then the digital qualification could more aptly and more productively be that barrier.

If your club believes any of these ideas have merit please write to the WIA Federal Office, stating your views.

Well — as you can see, VK5EJ and his club are indeed suggesting some fairly major and wide-reaching changes, to both the WIA itself and the way that amateur radio is administered in Australia. The WIA to be the SMA's authorised agent for fee collection; membership of the WIA to be effectively compulsory for all hams; affiliated radio clubs to provide the main representation on the state (and hence federal) councils of the WIA; digital communications skills and/or knowledge to be an alternative to Morse in the licence requirements; and again, the commercialisation of *Amateur Radio*. There's a quite lot to think about there, isn't there?

I don't know about you, but I can see plenty of positive aspects for the longer-term future of amateur radio, in these suggestions. But I can also see a few potential problems there, as well.

I'm not sure how many hams would accept the idea of compulsory membership of the WIA, for a start — although this would obviously get around one of the traditional problems associated with making *Amateur Radio* available on the news stands (namely, people dropping out of the WIA and just buying the magazine).

Similarly it does make sense for affiliated radio clubs to have more of a say in the running of the WIA, as they can clearly represent the interests of, and provide services for quite a few hams who are relatively distant from the WIA's own centres. But what about hams for whom even the nearest affiliated radio club is too far away to make membership realistic? They could end up being effectively unrepresented in the WIA hierarchy, despite their being forced to become a member...

And then there's the thorny subject of Morse code, and whether or not an alternative qualification is acceptable. Quite apart from the conservative old timers, who generally seem to adopt the belief that 'I had to pass Morse, so everyone else must do it too', there's also the question of *international* regulations. My understanding is that on the HF bands, the ITU/IARU require amateur operators to have at least a basic Morse qualification, and this could not be changed unilaterally by either the SMA or the WIA.

I suspect, then, that before this particular change proposed by VK5EJ and the LEPARC could be implemented, the ITU/IARU regulations would need to be changed. Probably this could only happen after protracted representations at future WARCs (world amateur radio conventions), so it's probably not a good idea to hold your breath, folks.

Still, the letters from both VK2XCI and VK5EJ/LEPARC show that people are indeed thinking constructively about the future of amateur radio and the WIA, don't they? Hopefully the criticisms we've published from Tom Moffat, the 'old fogie' and others have helped to get this happening...

Soldering safety

Another subject that keeps on bubbling to the surface is soldering safety — no doubt triggered off by the letter from 'Jamo' I published in the June column, and the little 'Solder Fume Buster' project we described in the July issue.

The latest letter to arrive on this subject comes from reader Garry Boyce, of Crafers in South Australia. Garry has some direct personal experience in this area, and his comments are therefore very relevant:

Just a quick note regarding the discussion of eye safety and soldering fumes, in EA recently.

I once had a painful accident while unsoldering some thick wires on a power supply. As I melted the solder a wire which had been under tension flicked up, and sprayed molten solder into my eye. I rubbed my eye and didn't think much about it, but as I drove back to town from the remote repeater site, my eye started to get very sore.

The next morning I woke up in complete agony, and went to the doctor. Until then I hadn't realised that the solder was still imbedded in my eye. The doctor

had to scrape the small ball of solder out with a hypodermic needle, as it was under the surface of my cornea. A rather unfortunate experience, especially as he warned me that if I blinked during the procedure I might have done even more damage to my eye.

Another time to take care is when cutting off component leads with side cutters. I once had a tiny piece of IC leg flick up into my eye as I cut off the excess leg length on a thin PCB.

A tech in our workshop has made a simple fume disperser using a small fan from a computer power supply. It mounts on a small block of wood and is placed close to the article being soldered, to suck away the fumes. It seems to be surprisingly effective.

I wonder if we should be more worried about lead ingestion from holding on to the solder. Production line workers must spend much of their working lives with their fingers in contact with a roll of solder.

While I believe we should take safety seriously, I think most of the precautions are just common sense. The safety officer where I work has taken things to the extreme. The walls are covered with infantile posters, and they have removed all of the chairs with wheels in case we fall over, etc. I feel that if an employee is dumb enough to fall off his or her chair, then it is their own fault and the employer should not be liable.

Hmmm... Thanks for those comments, Garry. Although I've never had solder flick into my own eyes, or seen it actually happen to others, your letter certainly makes it clear how easily this can happen. Your point about a similar risk when you're cutting off excess component leads from a PCB is also very relevant, I believe. I've often had those little bits of component lead fly off at speed during such operations, and I imagine it would be all too easy for them to go into an eye.

I guess the obvious conclusion to draw, from the first part of your letter, is that those who recommend that safety goggles should be worn by everyone doing soldering are no doubt right. It's all very well for those of us who *haven't* had this kind of accident, after decades of soldering, to scoff — but it looks like we've simply been lucky, doesn't it?

Now I come to think about it, there *have* been one or two occasions where I've had solder flick up and lodge on my glasses. Just as well I've had to wear them for quite a few years now...

Despite any sceptical comments I may have made previously, I'd certainly now recommend that anyone who *doesn't* normally wear glasses *does* wear safety goggles, when they're soldering. Don't worry about possibly looking a bit of a Wally — it's better to have your vision intact, surely.

It's interesting that the tech in Garry's workshop seems to have independently developed a solder fume disperser that's very similar to Bob Parker's Solder Fume Buster, isn't it? It sounds like the only real difference is that one sucks the fumes away, while the other blows them away. Great minds think alike, I guess.

By the way, Bob Barnes of RCS Radio tells me that although quite a few of the PC boards for the fan speed control part of Bob Parker's Fume Buster have been sold already, not all that many buyers seem to be using them for the original purpose. Most of them seem to be building up the board to control the speed of the cooling fan in their computer — because they find it too noisy when it's running flat out!

Oh well, perhaps if Bob Parker had designed the project as a speed control for computer cooling fans, people would have adapted it for use in controlling a solder fume sucker/blower...

You can't always predict which projects will turn out to be popular, let alone what people will want to use them for.

Returning to Garry Boyce's letter for a moment, that comment about the possible risk from protracted holding of lead solder is also quite relevant. As a typical user I guess I've been aware of this risk too, and have always tried to wash my hands thoroughly after each session where I've been soldering. But is that enough?

Probably a better approach would be to wear some kind of light gloves; but I can imagine many people would see this as going too far. A bit like removing all of the wheels from the chairs, as Gary suggests himself.

The question of responsibility and liability for industrial accidents is a very thorny one, of course. I read a piece in the paper only the other day, about the difficulty in getting building workers to wear hats and shirts, to protect themselves from excessive ultra-violet exposure and reduce their risk of getting melanomas. How far should an employer have to go, in order to protect employees from danger? Presumably only a certain way, as Garry Boyce suggests; after that, we employees must surely take responsibility for our own actions.

And that's all for this month, folks. I hope you'll join me here in the Forum next time. ❖

THE SERVICEMAN

The colour TV that only worked when the back was off the cabinet!

It's contributor's month again, and this time I have four stories from three readers. They're a varied lot, this time — covering TV repairs, tracking down faults in an electronic organ and an intriguing power reticulation/RF interference problem. I think you'll find them interesting...

First cab off the rank comes from Tasmanian reader S.W., of Lower Longley. S.W. gives us two shorter yarns about TV repairs, although the second story is about a fault-finding exercise which must hold some kind of record for longevity. Here's what he has to say...

One of my recent repairs involved an AWA television, a model C5321 fitted with a QM chassis. The complaint was simply that it wouldn't work. I plugged it in and switched on, but apart from a slight whistle from the horizontal stage, not a lot was happening. As I removed the back to have a look around, electrolytic capacitors C412 and C413 immediately caught my eye. One had a large split in its plastic coat, while the other's aluminium can had risen half way up the capacitor, exposing its naked innards.

A quick check with the meter showed 70V across each capacitor, which seemed a bit high considering their 50V rating! I grabbed a copy of the circuit, to see if I could work out what was going on. These capacitors are a pair of 330uF 50V units, connected in series off the emitter of Q402, one of the vertical output transistors. The collector of Q402 goes to the 115V rail, which at this time was up to 140V.

The transistor's base also read 140V, which along with the 140V on the emitter looked suspiciously as though the transistor was shorted. However, a check with the meter showed it to be OK. So then I thought that Q403, the other output transistor, might not be getting any drive. This could turn off the vertical output and do funny things to the supply voltages.

So I turned my attention to IC401, which contains the vertical and horizontal oscillators and is directly connected to the base of Q403. Pin 12 of IC401 is connected to the 12V rail, which is in turn derived from a 20V rail, which comes from the line output transformer.

Pin 12 measured 0V and suddenly, the penny dropped. I realised that the line output stage was probably not working. I traced back along the 12 and 20 volt rails, but there was no voltage anywhere.

So the real problem was no line output — hence no load on the power regulator, which sent the 115V rail up to 140V. This then played havoc with the vertical output and killed the two capacitors. Phew!

Unfortunately, I still had to find out why the line output wasn't running. So I reached over to pick up the circuit diagram, and in the process gave the chassis a bit of a bump. Suddenly the set burst into life, but only for a few seconds.

"It's an (expletive deleted) dry joint", I muttered. "I bet it's on the horizontal driver transformer!"

I flipped the chassis upside down and there it was — a pin with a blob of solder attached, but otherwise hanging loose in the breeze. For once, I had beaten Mr Murphy! I resoldered the joint, replaced the two capacitors and was rewarded with a fully working set. But I certainly took the 'scenic route' to reach that common fault...

Now, for my next act, I'd like to tell you about a fault which took something like five months to find and fix. It was an NEC portable colour set, a model N3419 and again, the customer said that it just wouldn't work.

With all the arrogance of youth, I thought to myself "This shouldn't be too hard!" Then I plugged it in, and confirmed that the customer was right — it wouldn't work.

I removed the cabinet back and checked that the fuse was intact, and that there were no silly faults like shorted line output transistors etc. Then I plugged it in again and switched on, preparatory to taking a few voltage readings. Except that I didn't need to — the set was working perfectly, with good sound and picture. I bumped and thumped and prodded and poked, but nothing I could do would bring on the earlier symptoms.

This HAD to be a dry joint, so I turned the board over and inspected the solder joints; but they all seemed to be OK. Just to be sure, I resoldered the ones around the power supply and the line output stage — places where dry joints commonly open up.

I let the set run for a week and there was no further trouble, so I returned it to the customer. I explained that I had not found a definite problem, but since the set had worked well for a week, I had confidence that it would continue to work well. As usual, I impressed on him that he should bring it back if he had any doubts that it was properly cured.

Well, he was back within a week — and so was the fault. It was a complete replay of the previous four para-

graphs. As soon as I moved the cabinet back, the set came good and refused to play up again.

I explained all of this to the customer when he picked the set up. There was really no way I could find the fault while it remained intermittent. It would only show up with the cabinet back in place, and there was no way I could fix it with the back on! I suggested that the only hope was that the fault would become permanent. Then I could do something about it.

After that, months passed and I saw no more of the customer and thought no more of the job. But finally I was brought down to earth with a thump. Five months had elapsed before he showed up again. "This time", he said, "the fault has become permanent!"

I asked how he could be so sure, and this is the story I got: Since I had told him the set came good whenever I removed the cabinet back, he decided to do just that rather than bring the set back to me whenever it failed.

In fact, he didn't remove the back completely, just loosened the screws by a centimetre or so and jiggled the set about a bit. He'd done this every week for five months, getting more and more frustrated each time, until finally there happened what I had hoped for all those months ago — the fault became permanent!

On the bench, I confirmed all that he had said. The set was dead, except for a slight whistle from the line output stage and a glow from the tube heaters. I had a look around the board for any mechanical problems, and also looked for a few of the voltages that should have been accessible. Since I didn't have a circuit diagram, I wasn't trusting too much in what I found. Mainly, the high voltage rail was present, but not much else. Then I spotted a three pin voltage regulator toward the front of the board and decided that it was worth checking. So I flipped the board over to check voltages around the area. This proved to be the best idea I'd had all day, since there was a classic dry joint on the output pin of the regulator.

Pushing the pin one way with my meter probe brought the set to life. Pushing the pin any other way killed it. I couldn't see any relationship with the cabinet back, but obviously the back had been exerting just the right pressure, in just the right direction, to keep the joint closed — for most of the time.

This was definitely the fault that I'd been looking for. The regulator supplies most of the ICs in the set and since I resoldered the dry joint over a year ago, the set has been working perfectly. Still, I'm glad the owner decided to move the back of the cabinet himself every week or so. I'd have got very bored if he'd dragged it in for me to do!

I reckon you would have done, S.W. Let's see: once a week for five months, that's about 20 - 21 visits. He'd have been sick of it, too! Still, it's provided us with an interesting story, so it hasn't been entirely without benefit. Thanks for the yarns.

Old Hammond organ

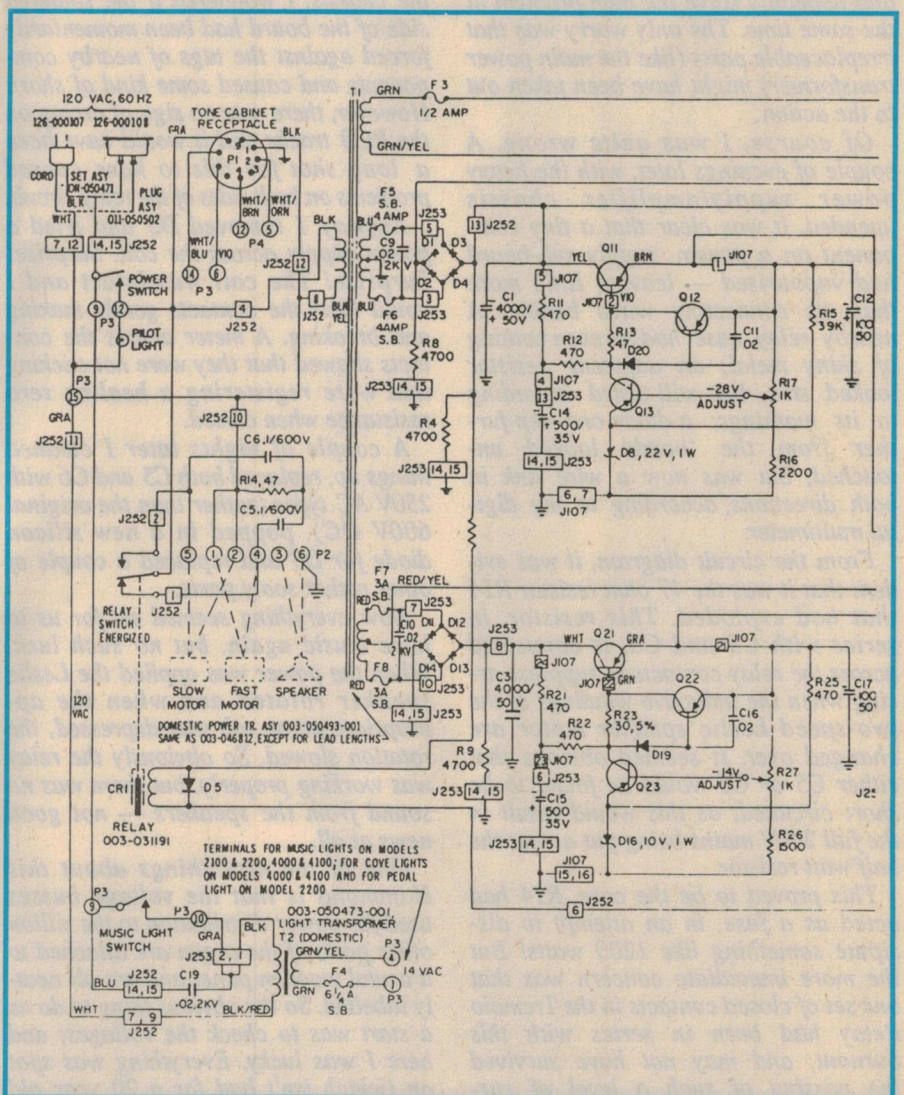
Now we move on to a story from W.P., of Croydon in NSW. This is the musical story I promised and as you will see, playing music on older instruments can call for a degree of mechanical and electrical ingenuity.

Here's what W.P. has to say...

We recently bought a lovely 20 year old 'Regent' model Hammond organ which is a traditionally voiced theatre style organ. It was manufactured sometime between the older draw-bar models with gear wheels whizzing around to generate the sounds, and the modern organs which are internally much more like a computer than anything else.

This one has a full-size console with two manuals and full pedal-board, the innards being absolutely chockers with PCBs loaded with discrete components and just a few ICs. We knew from the low price being asked, a fairly substantial hum level and a few other little faults that to keep it going would be a labour of love with maybe the odd expensive service call.

However, since I had done a share of service work back in the days of this style of construction, we thought the risk worthwhile. Part of the deal from the seller was a service call to try to fix the hum — but this was to no avail. How-



Part of the power supply circuitry for a Hammond 'Regent' theatre organ, which forms the subject of our story from contribution W.P. The organ stopped playing after a loud bang, and tracking down the causes took some time...

ever, the hum did seem to ease off a little with use, and oddly it would often cut back somewhat when the console lights were turned either on or off. This was strange as they are fed from a separate dedicated transformer. Anyway... I was happily playing some music of the 1930's one evening when there was a loud bang somewhere near my right foot, and then total silence. Only the console lights remained on, and there was a slight 'electrical' smell.

I turned it off promptly and promised myself to look for the trouble as soon as time allowed — although I suspected already that I would find a dried out electrolytic in the power supply, probably with its contents blown all over the place.

A replacement would set things right and hopefully solve the hum problem at the same time. The only worry was that irreplaceable parts (like the main power transformer) might have been taken out in the action.

Of course, I was quite wrong. A couple of evenings later, with the heavy power supply/amplifier chassis upended, it was clear that a tiny component on a power supply sub-board had vapourised — leaving little more than its connecting wires behind. A nearby relay case had an even coating of shiny metal; an adjacent resistor looked sick, but still tested according to its markings; a diode one step further from the 'bomb' looked untouched, but was now a wire link in both directions, according to my digital multimeter.

From the circuit diagram, it was evident that it was the 47 ohm resistor R14 that had exploded. This resistor, in series with C5 and C6, is connected across the relay contacts to suppress arcing when the inductive windings of the two-speed Leslie speaker motor are changed over. It seemed obvious that either C5 or C6 would be found to be short circuited, as this would result in the full 240V mains being put across the half watt resistor.

This proved to be the case. R14 had acted as a fuse, in an attempt to dissipate something like 1200 watts! But the more immediate concern was that one set of closed contacts in the Tremolo Relay had been in series with this burnout, and may not have survived the passing of such a level of current. It would be hard to find an exact replacement...

The diode I had found shorted was D5. Its role is to short out the voltage spike that is generated by the relay coil at the moment power is removed. This is usually necessary to protect the transistors which are used to switch the current. However, in this case a manual tab switch is employed for this purpose and is not likely to be damaged by spikes. It is probable that the diode is used here to render the switching electrically quiet, so that no click is heard in the amplifier when the tremolo status is being changed during a performance.

It was hard to see why 5 had failed — after all, it was electrically isolated from the original problem of the shorted capacitor. I could only blame the explosion, and as the PCB was mounted in a cramped and loose position beneath the chassis, I wondered if the soldered side of the board had been momentarily forced against the tags of nearby components and caused some kind of short. However, there was no sign of arcing on the PCB tracks and it would have been a long shot for this to have caused problems on both sides of the relay circuit.

Anyway, I removed D5 and tried a power supply across the coil. Surprise! Surprise! The coil was intact and I could hear the contacts gently making and breaking. A meter across the contacts showed that they were not sticking and were registering a healthy zero resistance when closed.

A couple of nights later I cleaned things up, replaced both C5 and C6 with 250V AC types (rather than the original 600V DC), popped in a new silicon diode for D5 and replaced a couple of other rather sooty parts.

Now everything seemed set for us to have music again, but no such luck. When the power was applied the Leslie speaker rotated and when the appropriate organ tab was depressed, the rotation slowed. So obviously the relay was working properly, but there was no sound from the speakers — not good news at all.

One of the nice things about this Hammond is that the voltage busses used for power distribution to the zillion other parts of the organ are attached to a cental wooden panel and are all neatly labelled. So the obvious thing to do as a start was to check the voltages; and here I was lucky. Everything was spot on (which isn't bad for a 20 year old piece of equipment) with the exception of the -28V line, which read zero.

This was tracked back to a burnt-out fuse in the line from the regulator. It didn't take long to power up the bench supply and carefully bring the output to -28V, at which point everything came alive and we had music again!

The supply meter showed a drain of only 210mA, so I had no reason to feel that there were any problems further down the line. I could only assume the fuse, being old and crystallised, had died as a result of vibration.

So off came the bench supply and in went a new fuse. But we still had a dead organ. The -28V rail now read only -14V. By turning the regulator trimpot, I could take the voltage down to zero, but could not get it beyond -14V. It seemed that there was a fault in the regulator!

Out came the amplifier again and I detached the power regulation sub-board from its edge-mounting slot above the chassis. There are four very similar regulator circuits on the same board, three of them being negative suplies. Using two of these as a comparison with the faulty one and using the DMM on 'Diode Test', it didn't take long to show up transistors Q12 and Q13 as the odd men out.

The precise technical faults were not important — all I needed to know was that they weren't right. With the transistors removed and the DMM on the regular ohms range, we were looking at a short circuit from emitter to collector in Q12, while Q13 had open circuit problems. Fortunately, 2N4249 transistors are still a standard line and a week later they were installed. In the meantime we had quite satisfactory music using the bench supply for the -28V line!

With the new transistors in place the -28V line came back to life. I took the precaution of replacing the two old electrolytics in this part of the works as a future insurance. Just why the regulator had packed it in was again somewhat of a mystery. Were we looking at the result of a power mains surge, or perhaps a spike caused by the temporary short (47 ohms) across the mains?

But what was most interesting — and highly satisfactory — was that while mounting and testing the regulator and relay boards, I was prodding around in the rats nest of sub-chassis wiring when the amplifier hum suddenly dropped away to a very satisfactory low level.

A bit more prodding revealed that the problem lay with an edge socket which supplied all connections (power in, signal in, signal out) to the Leslie speaker's

amplifier, and that the hum could be brought back at will.

When it was all cleaned up (although someone had obviously sprayed it and the whole amplifier with some sort of cleaning solution not long ago) and pushed firmly home, we had no more hum. Just which contact or contacts were at fault I don't need to know.

So there it is. A handful of faulty components and quite a few unanswered questions. But the instrument is up and running again, better than at any time since I bought it. I suppose it all followed the fairly routine failure of an old 0.1uF capacitor. Maybe the Serviceman can offer a better explanation.

Sorry, W.P. I can't think of any other reason for the problem. As you said, the original capacitors were 600V DC types and they were never intended to live across 240V AC mains. It's probably more surprising that they lasted as long as they did!

Anyway, thanks for your story W.P. It once again illustrates that common sense is just as valuable as wide experience, in tackling repairs to uncommon equipment.

Power problems

Our next story comes from H.W. of Innes Park, in Queensland. H.W.'s tale is not so much about repairing things, as finding out what was wrong in the first place. As you will see, the symptoms and the cure were easy to define — the difficulty was finding out exactly what was wrong!

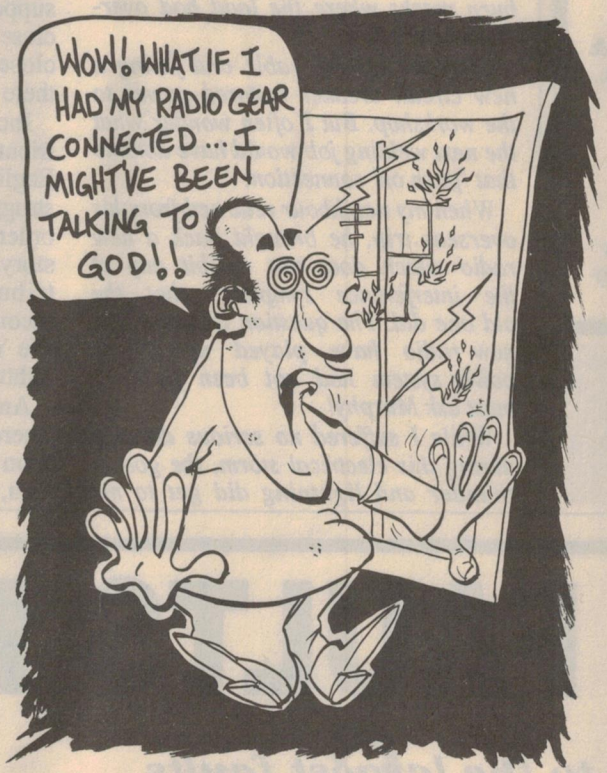
Here is H.W.'s story...

I have always enjoyed amateur radio, and having shifted into a new home, I made sure that there was enough room to plant an 'antenna farm'. As an amateur operator I could talk to the world and I seem to have found more pleasant people than Tom Moffat appears to get on to.

I had invited my new neighbours to contact me if they thought my hobby was giving them any problems. One neighbour approached me, stating that he had a problem listening to his overseas radio broadcasts whenever the lights in my radio shack/workshop were on.

His radio sits above his workbench in a steel shed. A metre of wire acts as an antenna, hanging to within 30cm of a fluorescent light. That's hardly the best way to listen to shortwave radio, yet it worked well enough for him — so long as MY lights were not on. If they were, his radio sounded as though it was working in the midst of a severe electrical storm.

Besides the radio gear in my workshop, there are NiCad and lead/acid battery chargers, electric clocks, alarm systems, various soldering irons and metering equipment, and all the other things which go to fill up my workshop. Switching each item on and off did not seem to make any difference to the interference.



By this time it was getting late, so we called it a day and decided to pursue the matter some other time.

Next day I checked my lighting and power circuits, but could find nothing wrong. In all this time, I had no trace of interference in my own television or radio gear. Then the neighbour left for an overseas trip, and since I had no problem myself, I did not follow the matter any further.

One evening about a month later I was in my workshop during the approach of an electrical storm. I had disconnected all of my antennas from the various equipment and was working on the repair of a small 240V-9V transformer from a portable radio. I had taken it out of the set and was holding it under a bright light that I use for detailed work. Somebody had pulled and twisted the very fine primary wires and they had shorted and burned through. However, there was enough left for me to make a satisfactory repair.

Then, when I considered the device ready for a test run, I connected it to a 240V bench supply. As I pressed the switch, there was a blinding flash and a very loud explosion. As my eyes recovered from the flash, I realised that the lights had gone out.

As I sat quietly waiting for my eyes to readjust from the bright work light to the near darkness, I looked out of the window and saw a most amazing sight. My antenna pole was enveloped in dancing red and white flames and from the long wire antenna, tails of this flame were arcing to ground and back to the pole. I had never been so pleased that my radio gear had all been disconnected from the antenna.

After some time my eyes adjusted to the dark and with the help of a torch, I checked the workshop fuses. I found the light and power fuses intact so if the failure was local, it must be at the main switchboard.

In the middle of the yard is a 240V sub-board, to provide lighting to that area. Being a new installation, it is fitted with circuit breakers and here the main breaker was OFF. Resetting it restored lighting to the yard, but still left the workshop in darkness.

Feeding all of this was the main house switchboard and at this point I noticed that the house lights were on. I inspected the board but found nothing out of place. Even the workshop circuit breaker was in the ON position...

The electrical storm was still going strong overhead, so I disconnected the supply to the workshop and left further investigation until the next morning.

Next day, with the circuit breakers ON, there was still no supply to the workshop fuse board. Fearing that I may have lost my underground cable, I commenced isolation of the cable section.

Murphy must have been still at breakfast because, with the cable isolated, the first screw I touched solved all the problems. The sub-board, which includes the workshop supply, was fitted with three almost identical circuit breakers. The difference lies in the holes for cable entry in the back of the devices. The one feeding the workshop has three holes, only two of which are

Continued on page 48

THE SERVICEMAN

Continued from page 47

for the cables. The third has screws which sets the tripping current.

The electrician who installed the system had apparently mistaken the trip screw for the cable clamp, and tightened it up quite firmly! The cable was in the correct place, but its clamp screw was fully undone. Only the pressure from the 75-amp cable had kept the system working. The end of the wire showed burn marks where the load had overheated the cable.

Cleaning up the cable and fitting a new circuit breaker restored power to the workshop. But I often wonder what the next welding job would have done to that 'push on' connection.

When my neighbour returned from his overseas trip, he brought back a new radio which does not exhibit any of the interference symptoms that the old one did. The question is, would the new radio have played up if my power system had not been fixed? I must ask Murphy!

While I suffered no serious damage during this electrical storm, the god of thunder and lightning did get to me sometime later. But that is another story. P.S. The small transformer repair was successful.

I'm glad the transformer repair worked out OK for you, H.W. With all the trauma of flames dancing around your antenna and push-on connections on 75-amp cables, I would not have been surprised if you had forgotten all about the radio job!

I still can't work out whether the lightning strike caused the power failure, or did both events happen separately but simultaneously. I don't suppose it matters, really. Being that close to a lightning strike is much too close for comfort. I'm just glad that there wasn't more serious damage done.

Incidentally, H.W. is another contributor whose 'Mother Tongue' is not English. Like A.K. in Tasmania, he has struggled with our convoluted syntax in order that he might tell an interesting story. I hope we can have more contributions from E2L (English as a second language) readers. Thanks, H.W. We will look forward to that other lightning story some day soon.

And that's it for this month. There'll be more stories next month, from my own bench and yours. See you then, I hope. ❖

Electronics Australia

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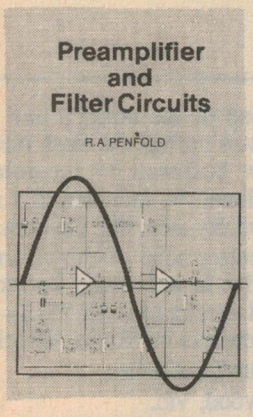
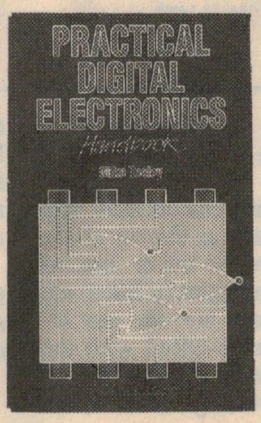


Preamplifier and Filter Circuits
This book provides circuits and background information for a range of preamplifiers, plus time controls, filters and mixers. The circuits described are simple and previous experience of electronic project construction is not needed.
CODE: BP 3090 PRICE: $11.00



Practical Digitial Electronics Handbook
This book introduces digital circuits, logic gates, bistables and timers as well as microprocessers, memory and input/output devices. It will prove invaluable to anyone involved with the design, manufacture or servicing of digital circuitry.
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Introducing Digital Audio, CD, Dat and Sampling. - Second Edition:
This book bridges the gap for the technician and enthusiasts who have worked with audio circuits. It includes oversampling methods and bitstream techniques and technical terms.
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Computers and Music - An Introduction:
This book explains how to simply set up your own computer music studio. It covers the basics of computing, running applications programs, wiring up a MIDI system plus everything about hardware and the programs.
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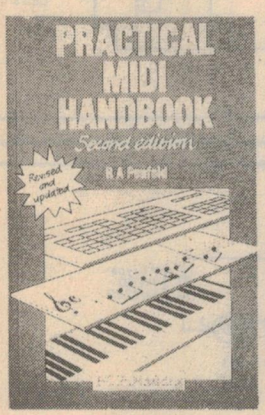

Practical MIDI Handbook
Refers to the powerful capabilities of MIDI and how to exploit it, with no knowledge of electronics or computing. It reviews the latest developments in MIDI covering keyboards, drum machines, sequences, mixers, guitars etc.
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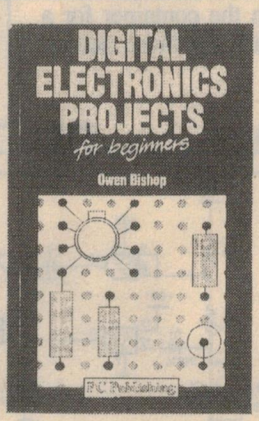

Digital Electronic Projects for beginners
This book provides simple, yet detailed instruction on practical projects. Covering instrumentation to home security plus circuit diagrams, this reference book also offers 'fun' projects for newcomers to electronic construction.
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Circuit & Design Ideas

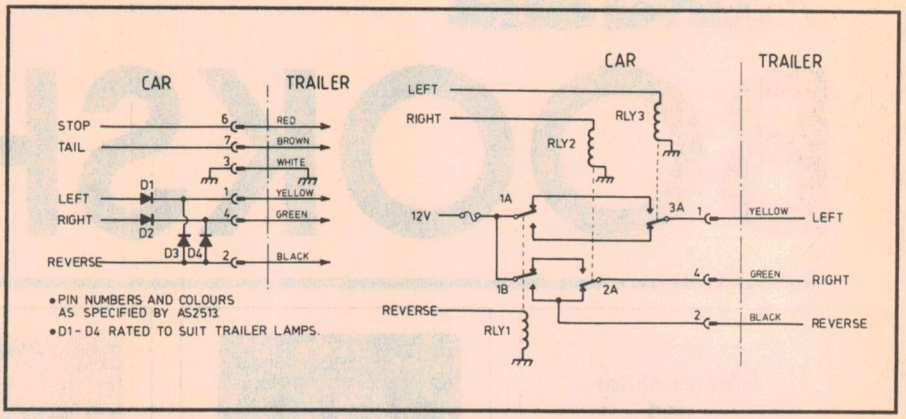
Interesting circuit ideas from readers and technical literature. While this material has been checked as far as possible for feasibility, the circuits have not been built and tested by us. We therefore cannot accept responsibility, enter into correspondence or provide further information.

Trailer reversing light

Like many people, although I don't own a trailer, my car has a tow bar and socket for one. On the odd occasions I need a trailer, I borrow one from a friend or neighbour. However, I have noticed that many trailers don't have a reversing light.

As such a light is very useful when you're reversing up a narrow driveway in the dark, I decided to modify my car wiring to allow a trailer's turn indicators to also function as reversing lights. Four diodes (of a suitable current rating) are needed, as shown in the circuit. If the trailer is fitted with reversing lights, they will work normally even with the diodes added to the car wiring.

The diodes can be mounted on the terminals of the socket, or taped into the wiring loom where the cable from the trailer socket joins the rest of the car wiring. I used 3A diodes type 1N5404, which have proved adequate. This circuit is simple and cheap, but it won't allow the trailer to indicate a turn signal while reversing. As well, an incorrectly wired trailer might cause a short-circuit that will destroy the diodes.



A better, but more complicated way is to use three relays as shown in the second circuit. Here the trailer turn indicators and reversing lights (if fitted) are isolated via relays and also the turn indicators are exclusive-ORed with the reverse signal, allowing a turn signal to be given while reversing. As well, the extra load of the trailer's turn indicator lamps won't affect the flash rate, as they are now buffered by the relays. The relays should be mounted in a relatively clean and dry area, like the boot.

Of course, none of this is any help if the trailer is not wired correctly. The standard to refer to is AS 2513 — Electrical Connectors for Trailer Vehicles.

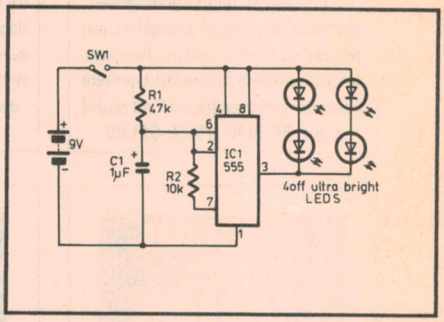
Graham Leadbeater,
Ringwood, Vic. **$40**

Bicycle tail light

I needed a cheap and simple flashing tail light for my bicycle after the original incandescent light met its fate on the roadside on evening. I came up with this basic 555 timer design, which I present in case other readers might want to save a few dollars.

Resistor R1 controls the off time of the LEDs and R2 the on time. The light output is produced by four high intensity red LEDs, driven directly from the output of the 555 timer.

I mounted the circuit on a small piece of strip board and placed it in a 50mm wide tablet container, with a toggle switch fixed to the back. The LEDs were mounted on the lid with a suitable red plastic cover. What's more, there's enough room left in the container for a few patches and glue, for those not-so-nice rides.



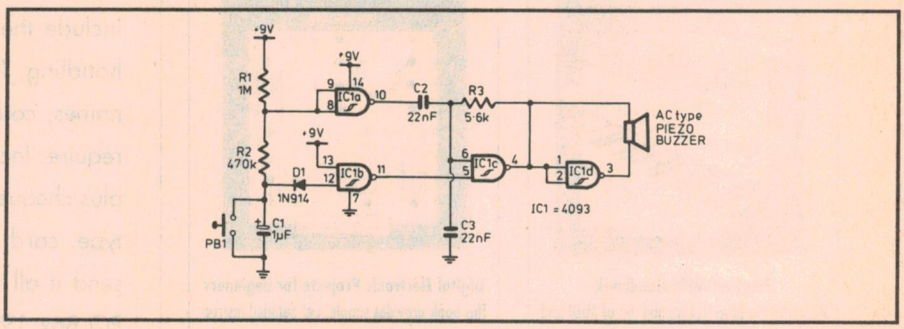
Anton Makotter,
West Croydon, SA. **$25**

Simple two-tone doorbell

This circuit is based on a similar circuit published in Circuit and Design Ideas, April 1994, except it uses fewer parts and only one IC. I developed this circuit as I didn't have the inverter IC specified in the previous circuit.

I used the two spare gates on the 4093, along with some rearranging of the components. The sound level is increased and battery operation is almost shelf life, as standby drain current is too small to measure.

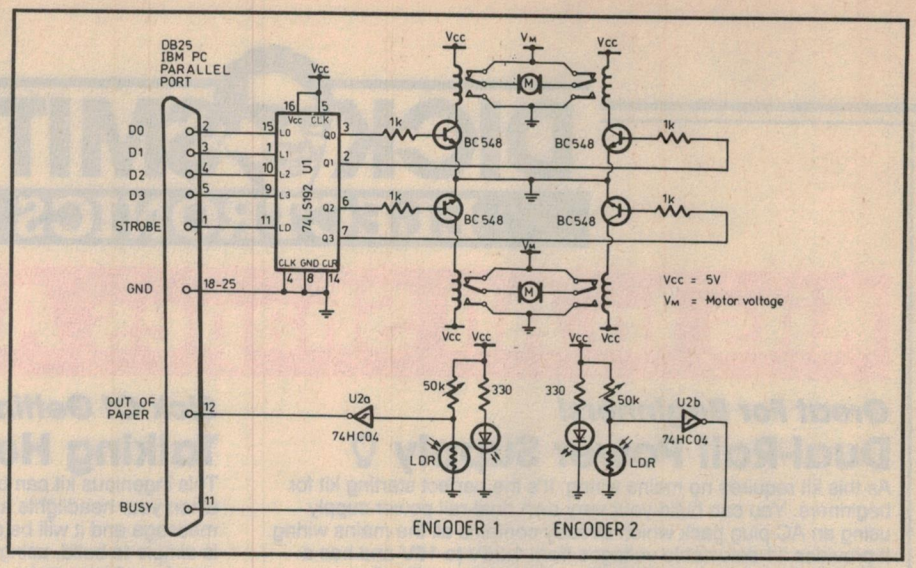
Timing between tones is provided by the circuit around IC1a and b; the tones are produced by the oscillator formed by IC1c, R3 and C3. The output to the piezo buzzer is from IC1d.



Because there are so few components, this circuit can be built with 'wire-wrap' construction, or on a piece of 25 x 25mm strip-board.

K. King,
Auckland, NZ. **$40**

Computer controller for DC motors



This circuit has proven useful when interfacing my computer to home made robotics. It is easy to build and use and it can control two DC motors of any current or voltage rating, depending on the rating of the relays. The circuit also provides two shaft encoders for positional feedback to the computer.

The motor control circuit is connected to an IBM PC parallel port, via U1, a 74LS192 four-bit latch. The first four data lines are used to control the motors, and the strobe signal from the computer stores the data in the latch. There are two separate motor driver circuits and each comprises two transistors and two relays. The relays need to be a SPDT or DPDT type, with a contact rating suited to the motor being controlled.

Each motor is controlled by two bits, giving four possible control actions for each motor. The first two data lines control one motor and the next two (D2 and D3) control the other where: 00 = stop, 01 = forward, 10 = reverse, 11 = stop.

The feedback part of the circuit uses the status lines of the parallel port. The shaft encoders attached to the motors consist of a metal or plastic disc with holes and a LED/LDR pair either side of the disc.

The inverters (U2a and U2b) condition the signal developed across the LDR and provide pulses with sharp rise and fall times to the computer.

The 50k variable resistors are adjusted so the inverter just switches on when the LED is shining on the LDR through a hole in the disc. The value should be around 17k, but this will depend on the LDR being used.

The encoder for motor 1 connects to the 'out-of-paper' status line, and the encoder for motor 2 connects to the 'busy' status line. The computer polls these two lines while the motors are turning.

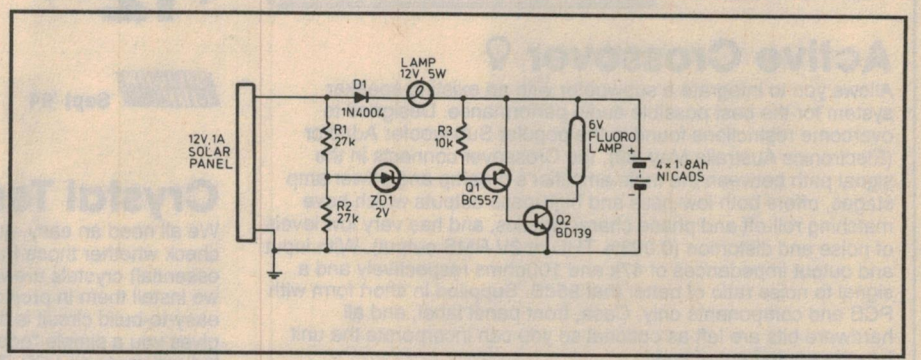
The software (written in turbo C) has two functions: to control the motors and to read the status of the encoder. More sophisticated software can be built using these two functions.

```
#include<dos.h>
#define TRUE 1
#define FALSE 0
#define ENC1 0x80
#define ENC2 0x20
int status(unsigned char encoder)
{
if((inportb(0x379) &
encoder) >0)return(TRUE); else return
(FALSE)
}
void DCout(unsigned char movement)
{
outportb(37A,3);    /*set load high*/
outportb(378,movement);    /*output
motor command*/
outportb(37A,2);    /*strobe*/
outportb(37A,3);
}
```

The status function is called with either ENC1 or ENC2 as a parameter which will return the value of the status of either encoder. The function needs to be called in a loop, and a counter included to count the number of holes passing each encoder. The control function DCout is called with a four-bit value (a data byte with the four higher order bits ignored). Each pair of bits represents the direction of each motor.

George Katz,
Dee Why, NSW. **$45**

Simple solar power light



This circuit charges the NiCad battery through the day and then turns on the light at night. The four fully charged 1.8Ah NiCad cells will supply a 6V, 0.3A portable fluorescent light for about six hours.

The battery is charged from the solar panel during the day via blocking diode D1 and a 12V 5W lamp. The lamp limits the charge current to 0.5A, and the diode stops the battery discharging through the solar panel during the night.

When there's sunlight on the solar panel, ZD1 is forward biased by the output voltage of the panel via R1. This holds Q1 off, which prevents Q2 and the light turning on. At night, when the output voltage of the solar panel falls, Q1 is turned on by base current flowing through ZD1 and R2. As a result, Q2 and the fluorescent light are also turned on.

The value of R2 is chosen to limit the base current in Q1, while still allowing a minimum voltage drop (0.2V) across Q2. This is important to get the lowest power dissipation in Q2 and to keep the efficiency of the circuit as high as possible.

After about six hours, the battery voltage falls to around 4V. The light is now turned off, preventing any of the cells being reverse charged. The lamp turns off at this point, as there is insufficient voltage from the battery to forward bias the 2V zener diode and the base-emitter of Q1, plus the voltage drop across R2. The next day, the battery charges and the cycle repeats.

David Francis,
Cannonvale, Qld. **$40**

DICK SMITH ELECTRONICS

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Cat K-3201

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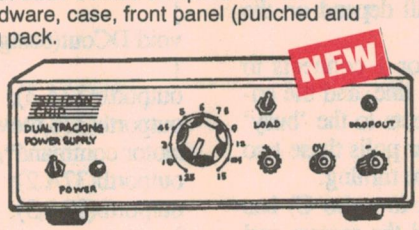


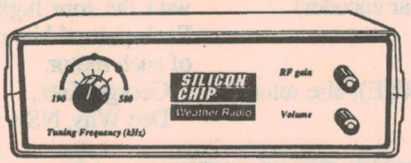
SILICON CHIP Oct '94

Weather Radio

You'll never get caught in the rain without an umbrella again! Once you've tuned into this weather radio, you'll always be up-to-date with the latest weather reports! Its coverage extends from 200kHz up to 580kHz which means that, unlike normal receivers, it picks up all of the airport weather beacons in the LW band. It's easy to build, using only two ICs and runs off a 9V battery. Supplied in full form with all components, PCB, case and front panel label.

Cat K-5022

$24.95



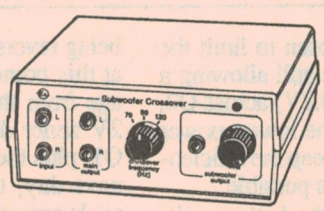
SILICON CHIP Sept '94

Active Crossover

Allows you to integrate a subwoofer with an existing speaker system for the best possible audio performance. Designed to overcome restrictions found in the popular Sub-woofer Adaptor (Electronics Australia May '89), the Crossover connects in the signal path between the main amplifier's preamp and power amp stages, offers both low-pass and high-pass outputs which have matching roll-off and phase characteristics, and has very low levels of noise and distortion (0.003% THD at 2V RMS output). With input and output impedances of 47k and 100ohms respectively and a signal to noise ratio of better that 95dB. Supplied in short form with PCB and components only. Case, front panel label, and all hardware bits are left as optional so you can incorporate the unit into the equipment of your choice.

Cat K-5404

$29.95



EA Sept '94

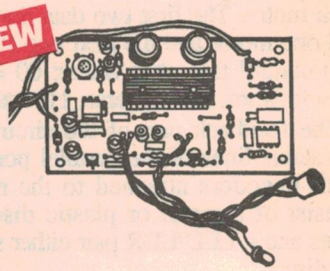
Sick Of Getting A Flat Battery?

Talking Headlight Reminder

This ingenious kit can be used as a reminder alarm to alert you when your headlights are left on. Simply record your own reminder message and it will be continually replayed for 30 seconds. The kit is simple to build, using a single sound recorder IC and an external speaker which can be mounted under the dashboard or under a seat. It can be used for a number of other applications - anywhere you need a solid-state message recorder that repeats a recorded messages for 30 seconds. Comes in short form with components, PCB, and hardware items such as switches, mic. insert, speaker and record LED.

Cat K-5024

$49.95



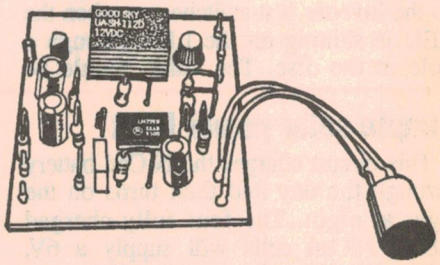
SILICON CHIP Oct '94

Mini VOX

Build your own tiny voice-activated relay! Great for amateur radio or where hands-free operation is required, it has a very short turn-on delay and will save you the hassle of pushing buttons every time you want to talk. Using just a single IC and an SPDT 12VDC relay, it's designed to fit in the tightest space and runs off just about any 12V DC supply. Supplied in shortform with PCB and components only.

Cat K-3038

$12.95



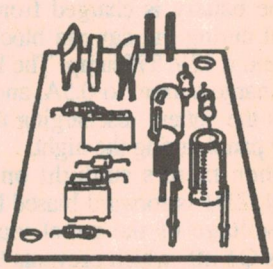
SILICON CHIP Sept '94

Crystal Tester

We all need an easy, quick way to check whether those fragile (yet essential) crystals are working before we install them in projects. Well, this easy-to-build circuit is the answer - it gives you a simple "good" or "bad" indication via an LED. The kit comes complete with PCB, all components and battery snap to suit 9V battery (not supplied).

Cat K-7228

$5.95



SILICON CHIP Aug '94

Please contact your nearest store for availability as some kits may still be in production.

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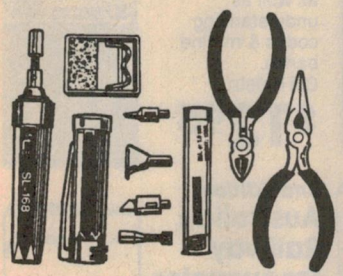
Cat T-1200



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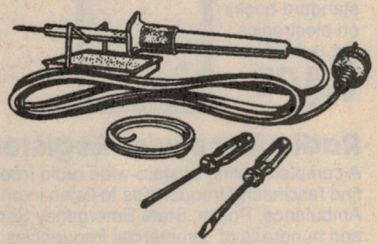
5-Piece Soldering Kit

Rated at 25W 240V, this general-purpose iron comes complete with resin-core solder, iron stand, cleaning sponge, and two screwdrivers.
Cat T-1652

SAVE $ 10



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Weller

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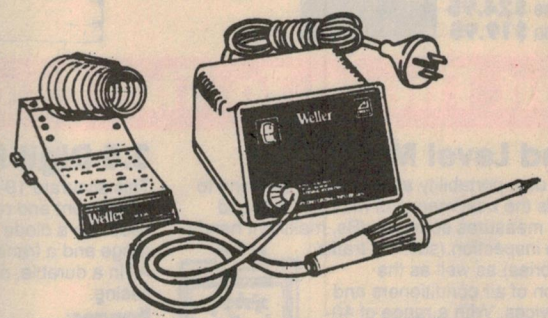

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0.71mm (22g)
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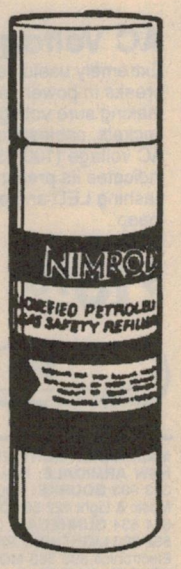

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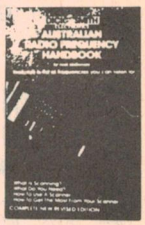

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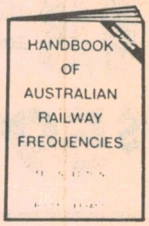

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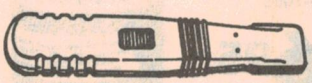

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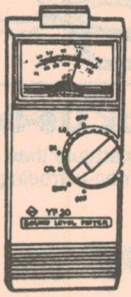

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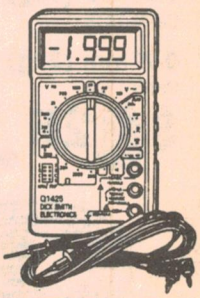

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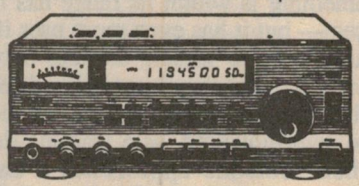

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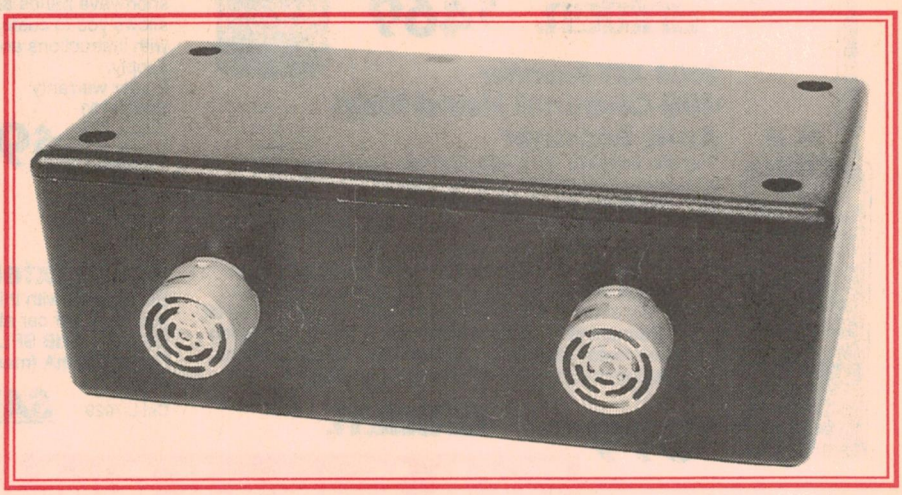
Construction Project:

LOW COST ULTRASONIC 'RADAR'

This simple unit sounds a buzzer and operates a relay when there's an object a preset distance away. The distance can be adjusted to anywhere between 200mm and over three metres. It uses an ultrasonic transmitter and receiver, two ICs and fits into a small plastic box.

by PETER PHILLIPS



Having a device that beeps when something is within its range has many uses — but it has even more uses if you can adjust the sensing distance between the device and the object being detected. Obvious applications include an aid for the sight-impaired, as a warning device when someone approaches a danger zone, or an alarm or buzzer to indicate when someone enters a door. For those trying to break the 'park by feel' habit, it can be used as a parking aid in a car.

It can also be used as a sensor in a burglar alarm. Because the detector triggers only when there's an actual object within range, it is less prone to false triggering than many other types of detectors.

The sensing range is from 200mm to over three metres, adjustable using a preset pot on the circuit board. For instance, if the range is set to say 500mm, an object outside this range will not be detected. Once the distance is reduced to 500mm, the unit will sound a buzzer and close a relay. If the object moves closer to the sensors, the buzzer will continue to sound and the relay will stay on.

This project, developed by Conrad Marder from Oatley Electronics, uses a 40kHz ultrasonic transmitter and receiver, and an LM567 tone decoder IC. The rest of the electronics is to drive a relay and sound a buzzer when an object is within range. It's simple and cheap to build and a kit of parts is available from Oatley Electronics, as explained at the end of the article.

How it works

The principle of operation is rather like a radar set, hence the name of the device. However, while radar uses microwaves, this one works with ultrasonic sound, which is sound with a frequency above normal hearing. In this case, the frequency is 40kHz, and the transmitter and receiving devices are designed to operate at exactly this frequency.

Both devices are made of a piece of piezo ceramic material, shaped to resonate at 40kHz. The transmitter therefore produces its highest output for a signal of 40kHz, and the receiver is most sensitive to a 40kHz sound signal.

The transmitter sends out a 40kHz tone, and the receiver picks up this signal after it's bounced off a distant object. Because ultrasonic waves travel at the speed of sound (about 340m/s), the time between sending a signal and receiving its reflection is a measure of the distance between the transmitter and the object causing the reflection.

If the ultrasonic sound is bounced off an object one metre away, the reflected signal will be received about three milliseconds later. However, the signal at the receiver will contain reflections from surfaces more than a metre away, so the circuit has to be sensitive to reflections occurring no later than three milliseconds after the original transmission.

This is achieved by sending *pulses* or bursts of 40kHz sound, rather than a continuous tone. Each burst of 40kHz is sent for about 1ms, with a delay of 30ms between each burst. If a reflected burst of signal is received within the time allowed, the sensing circuit responds. Reflections outside the preset time are ignored.

This sounds complex, but with the

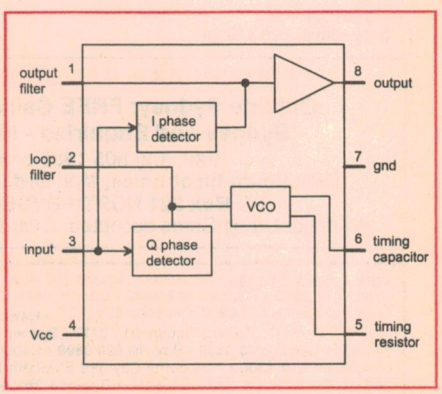
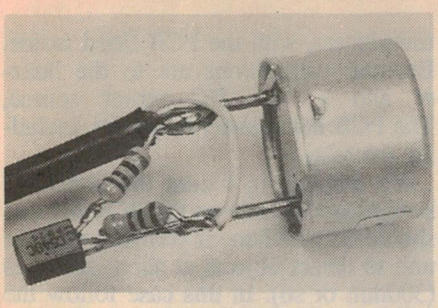
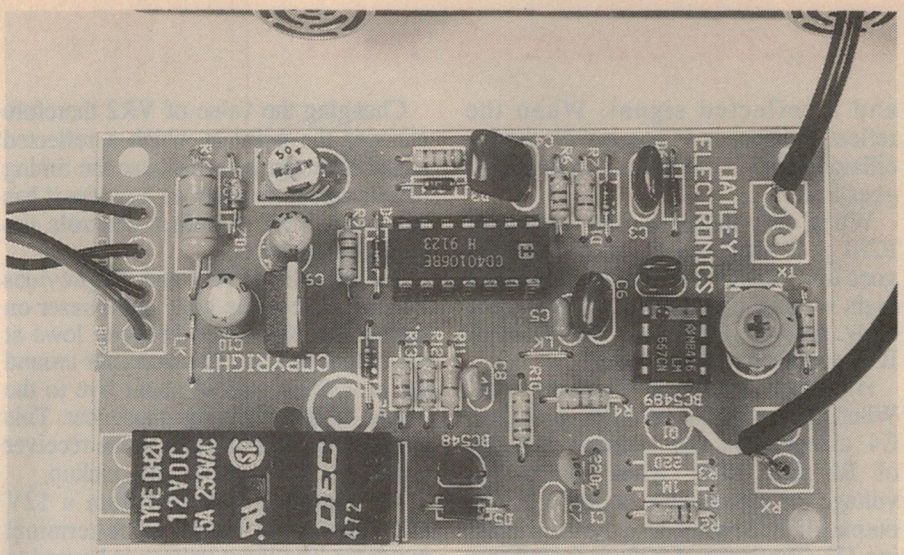


Fig.1: The block diagram of the LM567 tone decoder IC. The output at pin 8 goes low when the input signal is within the passband of the IC.



Here's how the amplifier components are mounted on the receiver transducer in the prototype. The component leads should be as short as possible.



In this close up of the PCB, the amplifier components are mounted on the lead of the receiving tranducer. Notice how the shielded cable from the receiver is connected to the PCB.

right IC it can be done with a few parts, as you'll see.

The circuit

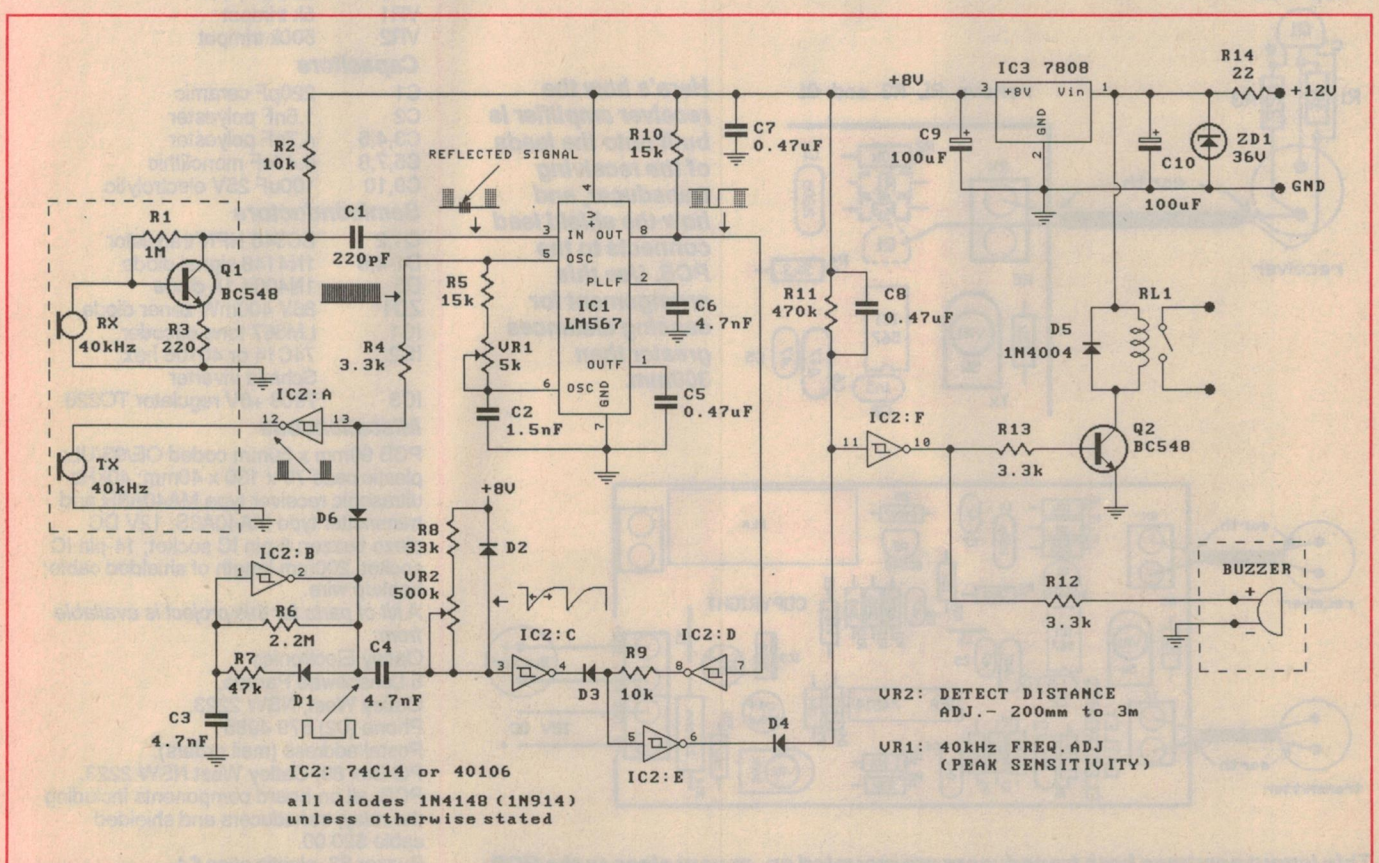
The main device in this circuit is IC1, an LM567 tone decoder IC. The block diagram of this 8-pin IC is shown in Fig.1. It's described as a general purpose tone decoder designed to send its output low when an input signal within the passband is present.

It contains an I and a Q phase detector, driven by a voltage controlled oscillator (VCO) that determines the centre frequency of the decoder. External components are used to independently set the centre frequency, bandwidth and output delay.

In the circuit diagram of the project (Fig.2), capacitors C5 and C6 are filter components, and the internal oscillator frequency is determined by the values of C2, R5 and VR1. The 40kHz oscillator output is taken from pin 5.

The circuit around IC2b is an oscillator to gate the 40kHz signal at the input of IC2a. The gating is achieved by D6 and the result is a 1ms burst of 40kHz every 30ms or so. As the waveforms on the circuit diagram show, the 40kHz signal is gated to the transmitter when the gating oscillator is high.

The received signal contains two components: the original transmission



The LM567 produces a 40kHz output at pin 5, and the received signal is applied to pin 3. A low frequency oscillator around IC2b gates the transmitted pulses, and the network around IC2c determines the sensing distance.

Low cost ultrasonic 'radar'

and a reflected signal. When the reflected signal is in phase with the oscillator signal at pin 5, the output (pin 8) goes low.

When this happens, the output of IC2d goes high, and the output of IC2e goes low. This drives the output of IC2f high, switching on transistor Q2 and the relay. As well, the high at the output of IC2f sounds the piezo buzzer.

However, there's a bit more to it. When the oscillator of IC2b goes low, C4 charges via the resistive network of R8 and VR2. When the charge voltage of C4 reaches a logic 1, the output of IC2c goes low, forward biasing D3. The input of IC2e is forced to a low, overcoming the high supplied by R9 from IC2d. This turns off the relay and the buzzer.

The setting of VR2 determines how long it takes for C4 to charge, and if the reflected signal occurs outside this time limit, there will be no response from the circuit. It's only when the reflected signal occurs before C4 has charged to a logic 1 that an output can occur.

Changing the value of VR2 therefore changes the point at which a reflected signal is recognised. Because the timing of this signal depends on how far it has travelled, VR2 therefore controls the detection distance.

The network of R11 and C8 provides a delay to keep the relay and buzzer on during the 30ms time between lows at the output of IC1. The amplifier around Q1 provides a gain of about five to the output of the receiving transducer. This amplifier should be close to the receiver transducer to minimise noise pickup.

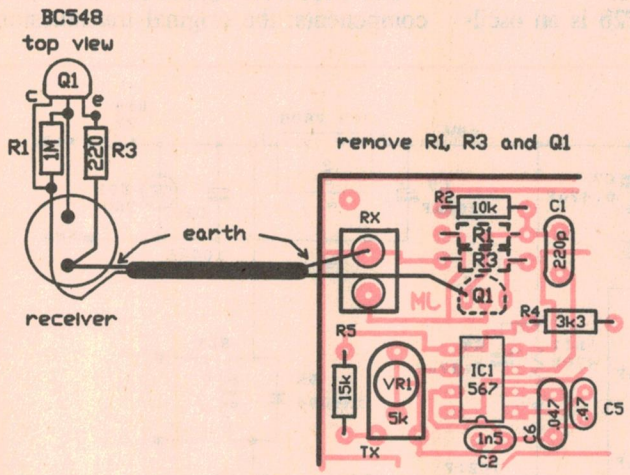
The circuit is powered from a 12V DC supply, via an 8V three-terminal regulator. The input voltage is limited to 36V by R14 and ZD1. The buzzer is a piezo device that produces an output when a DC input is supplied. Therefore, the buzzer must be connected with the right polarity. It is driven via R12 from the output of IC2f.

Construction

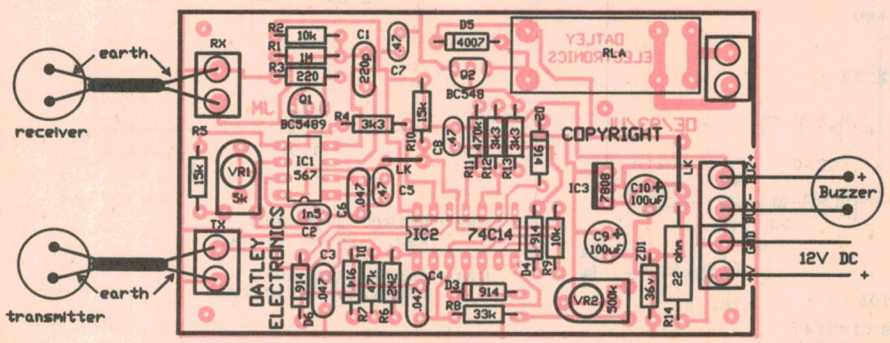
As the photos show, the plastic box holds the transmitting and receiving transducers, with the PCB fitted inside. External connections are to the buzzer and a 12V DC power source. The PCB holds everything else, including the relay.

It's possible to mount the ultrasonic transducers directly on the PCB, but this should only be done if you are using the unit to detect objects at short distances (300mm or so). In this case follow the layout diagram that shows all components on the PCB.

To detect distances greater than 300mm, mount the transducers on the side of the plastic box as shown in the lead photo. This allows the two transducers to be mounted apart from each other, reducing the amount of 'common mode' signal at the receiver. That is, the receiver picks up less of the



Here's how the receiver amplifier is built onto the leads of the receiving transducer, and how the shield lead connects to the PCB. Use this arrangement for sensing distances greater than 300mm.



This layout assumes both transducers are mounted on, or very close to the PCB. Make sure the earth braid of the shielded cable for both tranducers goes to the pin connected to the case of the transducer.

PARTS LIST

Resistors

All 1/4W, 5% unless otherwise stated:

R1	1M
R2,9	10k
R3	220 ohm
R4,12,13	3.3k
R5,10	15k
R6	2.2M
R7	47k
R8	33k
R11	470k
R14	22 ohm, 1W
VR1	5k trimpot
VR2	500k trimpot

Capacitors

C1	220pF ceramic
C2	1.5nF polyester
C3,4,6	4.7nF polyester
C5,7,8	0.47uF monolithic
C9,10	100uF 25V electrolytic

Semiconductors

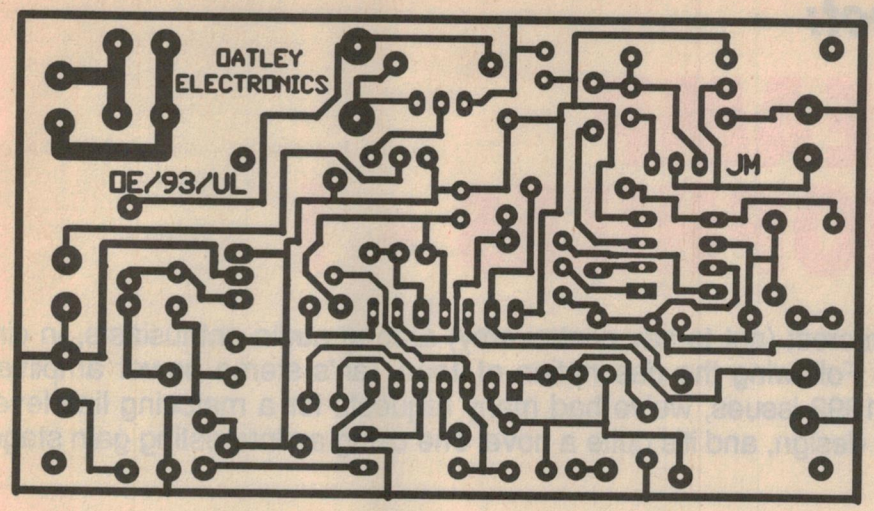
Q1,2	BC548 NPN transistor
D1-4,6	1N4148 signal diode
D5	1N4004 1A diode
ZD1	36V 400mW zener diode
IC1	LM567 tone decoder
IC2	74C14 or 40106 hex Schmitt inverter
IC3	7808 +8V regulator TO220

Miscellaneous

PCB 90mm x 50mm coded OE/93/UL; plastic case 70 x 130 x 40mm; 40kHz ultrasonic receiver type MA40A3R and transmitter type MA40A3S; 12V DC piezo buzzer; 8-pin IC socket; 14-pin IC socket; 200mm length of shielded cable; hookup wire.

A kit of parts for this project is available from:

Oatley Electronics
5 Lansdowne Parade,
Oatley West, NSW 2223.
Phone (02) 579 4985
Postal address (mail orders):
PO Box 89, Oatley West NSW 2223.
PCB, all on-board components including the relay, transducers and shielded cable $20.00.
Buzzer $3, plastic case $4.



The PCB pattern is reproduced here full size for those who want to make their own. The design is copyright to Oatley Electronics.

signal being produced by the transmitter, and therefore gives the circuit a better chance to detect a reflected signal.

For this, you'll need to mount the amplifier components Q1, R1 and R3 on the receiving transducer. The photo in Fig.2 shows a close-up of how the transistor and two resistors are mounted. The layout diagram for this arrangement shows where the connections go between the PCB and the receiver.

Build the PCB assembly first, taking the usual care with the diode, electrolytic capacitor, transistor and IC orientation. The ICs can be mounted in sockets, or soldered directly to the PCB. Note that the metal tab of the voltage regulator is towards the centre of the board.

The transducers are held to the plastic box with silicon glue and two holes for each device need to be drilled in the side of the box for the transducer leads. The transducers should be mounted so they are about 70mm apart.

Both transducers connect to the PCB with shielded cable. The cable length in the prototype for both devices is 120mm. It's important to connect the earth braid of the shielded cable to the earth pin of the transducers. This pin connects to the transducer's case, which is obvious by inspection. Mount the amplifier components on the receiving transducer after the device is fitted to the box. Keep the component leads as short as possible. The buzzer can be mounted inside the box, or externally. The power supply is external.

Getting it going

If you are using this project to sense objects more than a metre away, some form of acoustic isolation between the transducers will be needed. A piece of polystyrene or sponge slightly higher than, and wedged between the transducers will do. You might need to experiment with its height and shape for sensing distances above two or three metres. A piece of sponge rubber cut as a semicircle was used on the prototype, and it was possible to get reliable sensing of objects up to five metres away.

There are two adjustments to make: the sensitivity and the detect distance. The sensitivity is adjusted with VR1, located near the input leads from the transducers. This trimpot sets the operating frequency of the internal oscillator of IC1, and is a critical adjustment.

With a suitable 12V power source connected, set VR2 halfway and adjust VR1 so the buzzer sounds when an object is held in front of the transducers. You should be able to adjust VR2 (distance) to give a response to an object over three metres away. However, this setting is quite tricky, and you'll need to set the sensitivity pot VR1 very carefully. Shorter detect distances are not quite so critical.

The relay is rated at 240V 5A, but we don't recommend connecting 240V mains directly to the PCB as the track layout is not 240V rated. If you want to operate a 240V appliance, do it by using the on-board relay to switch another remotely placed relay.

And that's all there is to building this device. The PCB can be held in place inside the box with reusable removable adhesive (BlueTack or its equivalent). What use you put this project to is now up to your imagination. ❖

Construction Project:

VALVE PREAMP FOR AUDIOPHILES - 1

There's currently a good deal of interest (not to say controversy) among audio enthusiasts, in circuits based on thermionic valves. Following the description of Tean Tan's stereo power amplifier design in the October-November 1992 issues, we've had many requests for a matching line-level preamp design. Here at last is that design, and it's quite a novel one using an interesting gain stage configuration...

by TEAN TAN and JOHN SIOW

Readers of *Electronics Australia* will no doubt be aware that audiophile-quality preamplifiers can be very expensive, with typical retail prices in the thousands of dollars. One of the objectives of this project has been to give readers the opportunity to construct a high quality preamplifier at a much more reasonable price. Additionally, constructors can obtain valuable knowledge from this project such as audio circuit design and its flexibility, and the ways in which various components may affect sound quality.

The design is based on valves, which are currently being used by extensive numbers of audiophile equipment manufacturers and hobbyists throughout the world. The actual circuit configuration used in the gain stage is called a *Mu Follower*, which is by no means new; however its variations and application to audio have been discussed by many audiophiles in magazines such as *Glass Audio*. We believe this circuit is superior to many valve circuits as used in commercial preamplifiers, such as the cathode follower, etc.

The circuit design has been deliberately kept simple to ensure that signal integrity is maintained from input to output. Features such as tone controls, high and low filters are not included. This way the listeners are actually listening to the recordings from the source.

Vinyl recordings are no longer a popular source, and therefore a traditional 'phono' preamp stage is not included in the design. The complete project has a number of features, including four high level (line level) inputs (CD, DAT, Tuner and Tape) and a 'direct' input which bypasses the rotary switch. Outputs include Tape and Main, the latter being for connection to the power amplifier. A mute switch is also included.

A kit is available for the project, and this comes in a number of options to suit the needs of individual constructors. Please refer to the last section of this article for details.

The basic design philosophies embodied in the project encompass three main aspects: circuit design, component selection and circuit layout. These will now be treated in more detail.

Circuit design

Great sounding preamplifiers start with good circuit design; anyone can tell you that. In developing this project the criteria we used for the design were simplicity, low distortion at high output voltage swings, extremely high overload margin, wide frequency bandwidth, minimal phase shift right through the circuit, a high level of linearity and finally low output impedance to drive long interconnecting cables. All of these criteria are measurable and should ultimately determine the sound quality.

Over the past decades the evolution of a circuit topology for valve preamplifiers has ranged from the simple use of a cathode follower (near unity gain) to a two-valve configuration using a common cathode stage direct coupled to a cathode follower. The latter circuit was widely used by Audio Research and Marantz designers in their earlier days.

The basic circuit topology used in this preamplifier has its origin in the 1930's, and has continued until today. An early implementation of the topology is the shunt regulated push-pull (SRPP) stage, which was used extensively in power amplifiers.

In the early eighties it was introduced as a line preamplifier in the Beard preamplifier. This circuit has its limitations, one of which is the high output impedance — in excess of 1k ohms at mid-band frequencies, depending on the tube used. In 1985, Chris Paul's article in *The Audio Amateur* magazine discussed the use of a variation of this circuit, as shown in Fig.1. Paul also introduced an equivalent circuit for this topology.

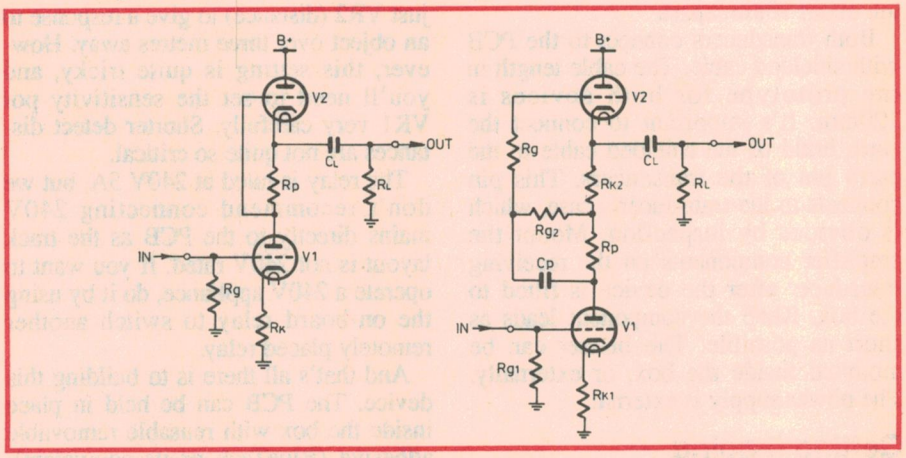
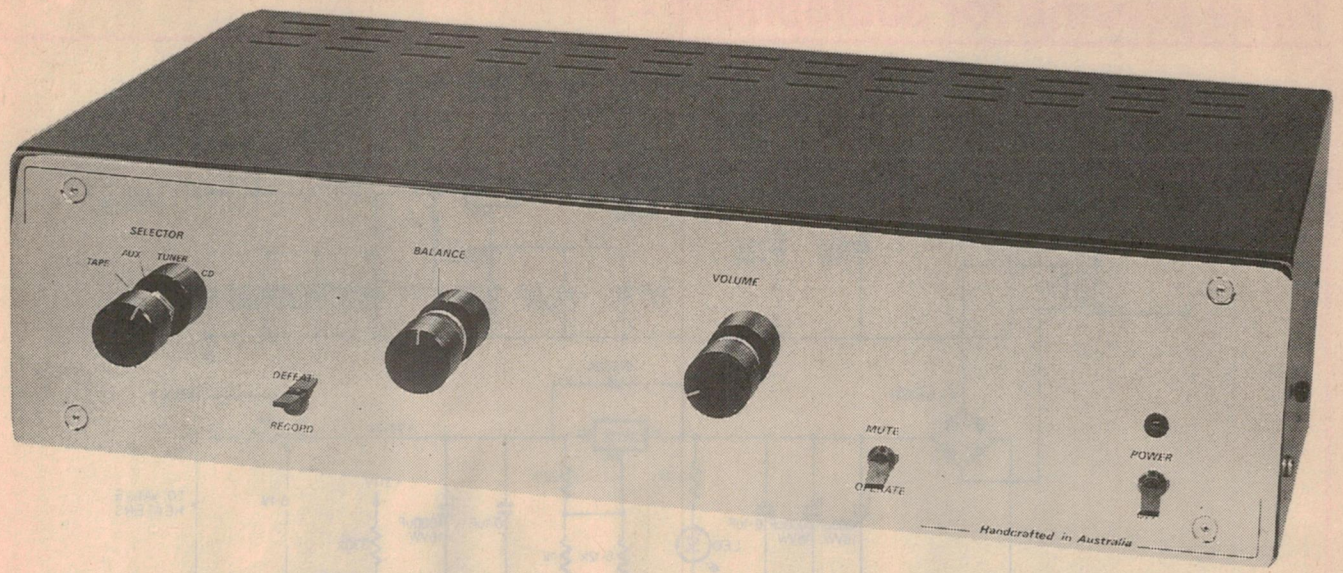


Fig.1: At left is the basic SRPP (shunt regulated push-pull) stage, as used in the original Beard preamplifier, with Chris Paul's adaptation on the right.



Using this topology and by taking advantage of other published research, the end result is the Mu Follower topology using two dissimilar valves. This circuit does in fact satisfy the previously noted design criteria very well, as you can see from the measured performance results.

Valve V1 acts as a common cathode stage, whose gain is determined by the anode impedance; this happens to be largely another valve, V2. The second valve acts as a 'current source' or active load for the first stage, but at the same time also acts as a cathode follower. The effective gain of this two valve topology is close to the mu (amplification factor) of V1. The two valves work in synergy to give a very low distortion even at high output levels.

A complete circuit of the Mu Follower is shown in Fig.2. Careful selection of the components is important to achieve a good technical performance as well as sonic reproduction. The valves chosen are easily obtainable from a variety of sources. The resistors are all of the metal film and metal oxide type, rated at 1W and 2W as appropriate. The non-electrolytic capacitors are metallised polypropylene and polystyrene types to give the best performance.

The valve used for V1 is the common 5814 (12AU7 or ECC82 or CV4003), biased at about 5.3mA. This is within the linear region of this tube. This valve was chosen because its nominal mu-factor is about 17 (24.6dB). This gain is more than sufficient in most line stage preamplifiers.

The top valve V2 must have a high transconductance, and the 6922 (6DJ8 or ECC88) comes to mind. The 5814 and 6922 are upgraded versions of the 12AU7 and 6DJ8 respectively. A high transconductance of the top valve will give a low output impedance. The bias current of V2 is about 7.3mA, which is adequate to achieve a transconductance of about 8mA/V. Again V2 is biased so it operates in the region of linearity.

Note that there is no overall negative feedback to this circuit; only local feedback for each valve as provided by the cathode resistors. Therefore there is no danger of instability and unwanted phase shift. The phase linearity is an important parameter in achieving a sonic coherency in music.

By the way, the authors do not suggest that amplifiers with overall feedback cannot achieve phase linearity; just that careful design is essential to achieve phase linearity.

The two low frequency poles are determined by the 0.22uF and 3.9uF coupling capacitors. The locations of these poles are spaced far enough so that there is no interaction. The two capacitors are also bypassed with small capacitors to improve transient response. The dominant high frequency pole is determined by the output impedance of V1, the input capacitance of V2 and stray capacitance.

The -3dB points on the preamplifier's frequency response have been measured at below 0.5Hz and around 200kHz.

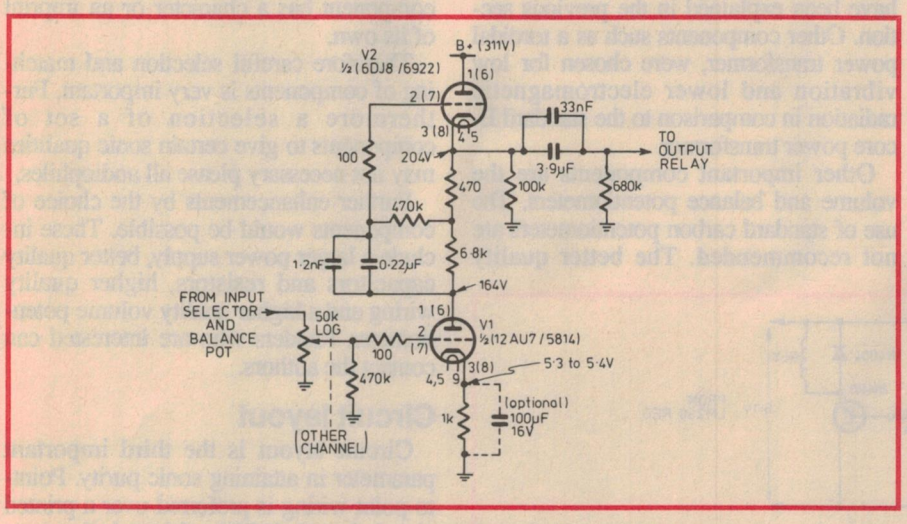


Fig.2: The gain stage configuration used in the authors' preamp, which has been dubbed the 'Mu Follower' topology. The upper valve presents a very high load impedance to the lower one, while also providing a low output impedance.

Power supply

The high tension B+ voltage is not critical; approximately 300V DC is suitable. The supply can be as low as 250V and as high as 320V. The high tension is actually regulated using solid state components, as you can see in Fig.3.

The main highlights of this circuit are the use of a TL783 regulator, which is an adjustable floating regulator whose output voltage is determined by the 390 ohm resistor and the 100k/1.2M parallel resistor combination. The TL783 regulator is preferred over the standard LM317 because of its lower noise output.

The IRF830 power MOSFET has a V_{DS}

Valve preamp for audiophiles - 1

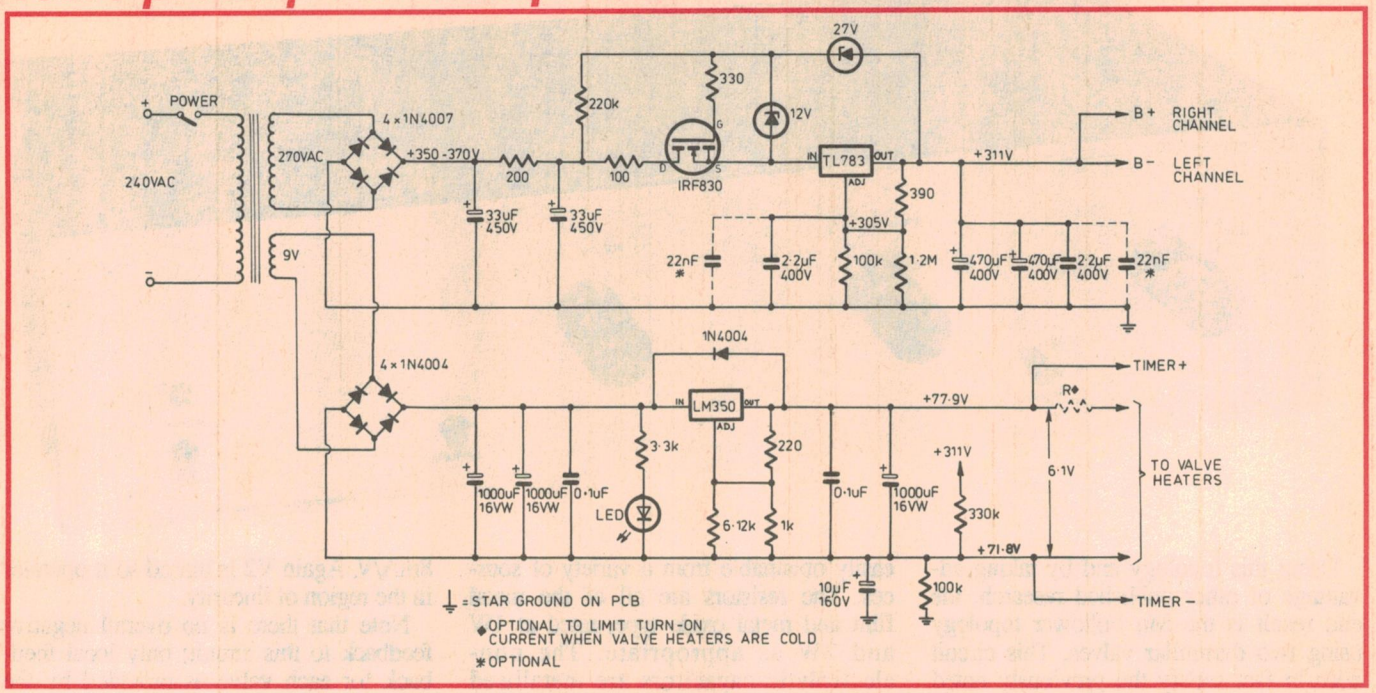


Fig.3: The power supply circuitry for the preamp. As you can see both the HT supply for the valves as well as their low voltage heater supply are electronically regulated, to stabilise the operating conditions and also reduce noise and hum to very low levels. The heater supply floats at about 70V to minimise heater-cathode leakage in the valves.

of 500V DC. This is essential to protect the TL783 from damage due to power-up transients. Sufficient storage capacitors are provided, 470uF per channel, to give the preamplifier the required bass extension.

To ensure the lowest possible hum level, the valve heaters are fed with DC. This is regulated to 6.1V with very low ripple, using an LM350 device. As the cathode of the V1 valve operates at about 5.5V DC, while that of V2 operates at about 200V, the complete heater supply circuit is arranged to 'float' at about 75V DC with respect to ground, by means of the voltage divider formed from the 330k and 100k resistors (Fig.3). This minimises the risk of heater-cathode leakage or breakdown in either valve.

Because of the relatively long time constant formed by the preamp's 3.9uF output coupling capacitor and 680k bleed resistor, the DC output voltage at the preamp outputs will take some time to settle down after power is applied. To prevent this from causing any audible effects, a simple timer circuit and relay are used to the disconnect output of the preamp at switch-on, and only connect it after about a minute. The timer circuit is based on a readily-available 555 device, and is shown in Fig.4. The 560k resistor and 100uF capacitor determine the delay time.

Component selection

Some of the reasoning behind the choice of component used, such as polypropylene capacitors and resistors, have been explained in the previous section. Other components such as a toroidal power transformer, were chosen for low vibration and lower electromagnetic radiation in comparison to the standard E-core power transformer.

Other important components are the volume and balance potentiometers. The use of standard carbon potentiometers are not recommended. The better quality types are conductive plastic or cermet, and these are far preferable.

The internal wiring is another important component. The kit for this project is supplied with silver and copper alloy wires. This type of wire represents the best value for money in the market, we believe.

The components chosen for this preamplifier are no means the ultimate quality, but an important feature is the careful use components in each and every location. Some components are 'bright' in character while some are less bright and others are neutral. Each type (brand) of component has a character or an imprint of its own.

Therefore careful selection and matching of components is very important. Furthermore a selection of a set of components to give certain sonic qualities may not necessary please all audiophiles.

Further enhancements by the choice of components would be possible. These include a larger power supply, better quality capacitors and resistors, higher quality wiring and a higher quality volume potentiometer. Readers who are interested can contact the authors.

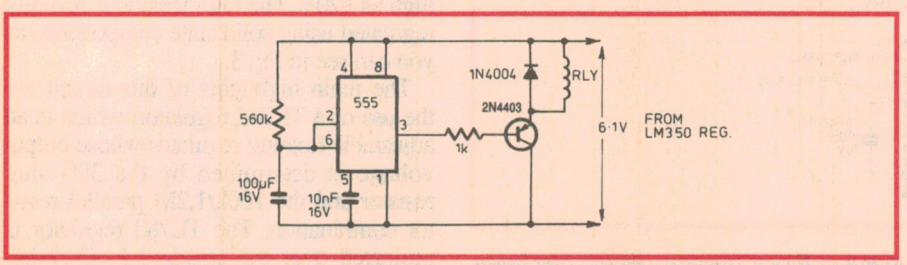


Fig.4: As the preamp output circuitry takes some time to stabilise after switch on, a timer circuit is used to connect the outputs only after a delay (about 1min).

Circuit layout

Circuit layout is the third important parameter in attaining sonic purity. Point-to-point wiring is preferred over a printed circuit board (PCB), although for convenience and minimisation of wiring errors the latter method is chosen. Therefore

MEASURED PERFORMANCE OF THIS PREAMP

The designers of this interesting valve preamp design sent us the prototype unit shown, and invited us to both measure its performance with our instruments and listen to it in a typical domestic environment. This is our report on what we found.

First, the measured performance:

Frequency response	0.5Hz - 200kHz (-3dB)	
Signal to noise ratio	-82dB (ref 1V RMS output)	
Total Harmonic Distortion (1V RMS output)	100Hz	0.038%
	1kHz	0.035%
	10kHz	0.037%
Intermodulation Distortion	0.14% (1V RMS output)	
Crosstalk between channels (ref 1V RMS output)	20Hz	-70dB
	1kHz	-67dB
	10kHz	-50dB
Slew rate	Approx 4V/us	
Output impedance at 1kHz	Approx 450 ohms	
Gain at 1kHz	24dB (Av = 15.8)	

The authors also provided an alternative ECC82 valve for the V1 stage, and we also tried measuring the performance with this in circuit. The only significant difference in measured performance was that the THD increased to 0.045% at 1kHz, while the IMD dropped slightly to 0.13%.

Note, however, that the distortion figures above were all taken with the preamp outputs loaded resistively with a nominal 100k. In the course of our measurements, we found that both the THD and IMD figures *dropped significantly* when the preamp outputs were provided with lower value loads. In fact if the loads were reduced to approximately 7.5k, both types of distortion reached a minimum. In this condition we measured less than 0.010% THD at 1kHz, 0.014% at 100Hz and 0.013% at 10kHz, and 0.02% for IMD, again at 1V RMS output.

We have discussed this with the authors. However they do not recommend reducing the loading to 7.5k, because although this does appear to minimise the distortion, it will also cause the low frequency response to roll off earlier (i.e., at a higher frequency). The -3dB frequency would rise to around 6Hz from the measured 0.5Hz, unless the output coupling capacitors (currently 3.9uF) were increased in value.

However readers contemplating building this preamp may wish to experiment with loading themselves, to find the best compromise between distortion and bass response.

How it sounded...

Our listening tests were actually conducted before these measurements were made. We used the preamp in conjunction with the Playmaster Pro Series One power amplifier, a good CD player and a high-quality speaker system, and were quite impressed with its sonic performance. The overall sound was clean and well balanced, with virtually no hum and very low noise for a valve circuit (only audible right at the speakers).

Playing familiar reference tracks from various CDs, the sound overall was very pleasing to the ear. Our only slight reservations were that we thought we could detect a very slight 'edge' on solo vocalists singing with a fairly complex orchestral background. This was with the preamp channels loaded only with the 33k input impedance of the Playmaster amp, and following our measurements we suspect that we were detecting the preamp's IMD in this condition. It seems likely that with the loading reduced to near 7.5k, this 'edge' would disappear.

In short, then, we found the performance of the preamp quite impressive. Those audio enthusiasts who want to use or experiment with a valve-based preamp design should therefore find it a very good choice.

a high quality PCB is used, with the copper tracks made as wide as possible in areas where this is required. The copper weight is also 'two ounce', twice the normal weight. Boards supplied with the kits will have a layer of lacquer to protect the copper tracks from oxidation and humidity attack.

The layout is such that there is a minimum of interaction between inputs and outputs. The outputs are laid as far away from the inputs as possible to avoid cross-coupling between inputs and outputs. Wherever possible the signal paths are kept to minimum length and only good quality switches are used through- out to reduce sonic colouration.

Earthing is always the main concern among audio constructors. The PCB is laid out such that all the ground connections are taken to a single point — the technique commonly known as 'star wiring'. This is the best method to avoid hum loops and the 50Hz mains hum they can inject into the circuit.

Possible enhancements

The design is flexible enough to allow constructors to perform various modifications, if they wish, to alter and enhance the sonic balance. These include:

1. The use of better quality components, such as MIT capacitors, Holco resistors, etc.
2. Experimenting with different brands and types of valves — e.g., 6CG7, 5965 etc.
3. Possible improvements in the circuit, such as bypassing the 1k cathode resistor of each V1 input stage with 100uF, to reduce the output impedance and distortion.

It is the authors' experience that these three factors affect the sonic balance of the music output. So constructors can experiment with these factors as desired, to obtain the particular sonic balance they prefer — e.g., better bass, smoother treble etc.

Sound quality

The authors set out with a specific sound in mind for this preamplifier. It should have high definition, including good clarity, good bass extension, smooth treble, tuneful mid-band and good tonality. These are the sonic qualities which typify a valve preamplifier. It must also have a 'big sound stage' with depth and extension. It must also be capable of handling fast transients from CD and DAT sources, without sounding sluggish or compressed. There must be a good balance between all of these sonic attributes to achieve musical coherence.

We believe we have achieved what we set out to do, and invite constructors to verify this for themselves.

In the second of these articles, we will present the construction details for the preamplifier. In the meantime, for those readers interested in obtaining the kit, it is available from Contan Audio, of 37 Wadham Parade, Mount Waverley, Vic 3149; phone/fax (03) 807 1263.

The kit comes in a number of options:

A. PCB only $45.00
B. PCB and all components ... $289.00
C. Toroidal transformer $85.00
D. Alps volume, balance pots ...$49.00
E. Case & all components except items B, C and D $269.00
F. Complete Preamplifier kit (B+C+D+E) $649.00
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The components supplied in this kit are of very good quality. For example the pots are from Alps, the capacitors from Wonder and Solen, the resistors from Beyschlag and Philips, and the electrolytic capacitors from Panasonic and Nippon ChemiCon. The valves supplied are military grade 5814 (12AU7 equivalent) and 6922 (6DJ8 equivalent) types. The toroidal transformer is 'over designed' to run with very low temperature rise, while as mentioned earlier military grade hookup wire, silver contact switches, a high quality IEC socket and power cord are supplied. The case is of high quality aluminium, fully screen printed and professionally finished.

Incidentally individual components can also be obtained from Contan Audio; send a self-addressed envelope with $1.00 stamp for a catalog.

(To be continued.) ❖

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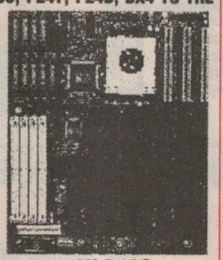

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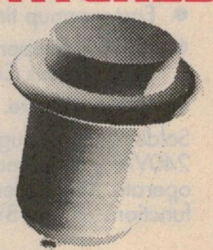
- **Power OCR** - optional Recognita Plus OCR means you'll never have to re-key data again. **Auto-Document Feeder** (ADF-I) and **Transparency Unit** (TMA-I).

PLASTIC KNOBS

Cat No	Colour	Height	Base	Price
		Matt plastic knobs with removable coloured tops and indicator. Push on spline mount.		
H10007	*Green*	16mm	13mm	$0.95
H10008	*Blue*	16mm	13mm	$0.95
H10009	*Red*	16mm	13mm	$0.95
H10016	*Yellow*	16mm	13mm	$0.95
		Grey plastic knobs with removable coloured caps and indicator. Spindle collet.		
H10096	*Blue*	17.5mm	15.5mm	$2.95
H10097	*Green*	17.5mm	15.5mm	$2.95
H10098	*Red*	17.5mm	15.5mm	$2.95
H10099	*Red*	17.5mm	15.5mm	$2.95
		Grey plastic knobs with removable coloured caps and indicator. Spindle collet.		
H10000	*Blue*	16.5mm	21mm	$2.75
H10001	*Green*	16.5mm	21mm	$2.75
H10002	*Red*	16.5mm	21mm	$2.75
H10003	*Yellow*	16.5mm	21mm	$2.75

LARGE SWITCHES

As used in Pinball and Arcade Machines. Ideal for easy identification and use by the disabled and patients in hospitals or the elderly. Comes in bright colours.



S11066....	$3.50	RED
S11067....	$3.50	GREEN
S11068....	$3.50	BLUE
S11069....	$3.50	YELLOW
S11071....	$3.50	ORANGE

SWTMOTHR

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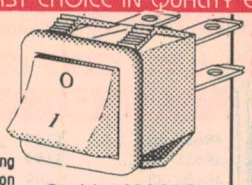
ON-OFF SWITCH

IN STOCK FOR COMPUTER CASE

Curved Rocker Switch

- Attractive snap in panel mounting DPST Rocker switch. Connection is by 6mm blade terminals, suitable for crimp connectors.
- Panel cutout 25 x 25mm
- Max panel thickness 3mm
- Switch rating 10A@150VAC.



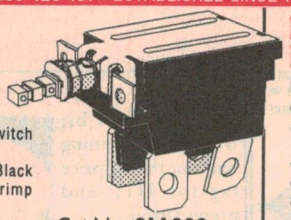
Cat No. S11005

1-9 $6.95 | 10+ $5.95

POWER SWITCH

Push on- Puch off power switch assembly

- Screw mounted (Ø 3) switch assembly DPST
- Connection is by 6mm Black terminals suitable for crimp connectors
- Mounting centres 20mm
- Switch rating 5A@150VAC
- Suitable for power switches in minitowers and new baby AT casing.



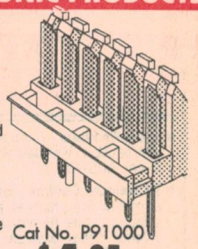
Cat No. S11002

1-9 $7.95 | 10+ $6.95

POLARISED PCB HEADER

HIGH POWER PCB HEADER, 6WAY.

- Tough nylon insulators are polarised to ensure correct mating.
- Current ratung 6 way max 8A
- Contact resistance 10mΩ max
- Insulation resistance >10^3MΩ min
- PCB pitch 3.96mm (0.156") Suitable for computer motherboards



Cat No. P91000

$4.95

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Now you can really turn up that special sound effects from your games or multimedia stuffs. It will rock you and sends shivers up your spine!

Specification:

Power:	DC6V (four batteries or one AC/DC power adaptor)
OUTPUT:	2W per speaker
Frequency:	50 -15,000 Hz
Impedence:	4 Ohm per speaker
Size:	150mm x 92mm x 100mm

Cat No. C10188

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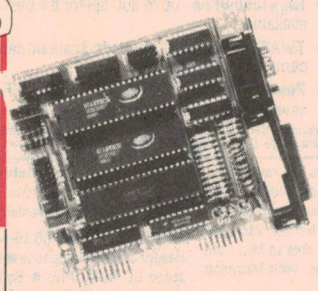
SERIAL 2-PORT 16550AFN HIGH SPEED AT MULTI I/O CARD



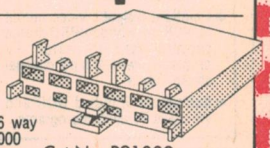
Cat No. X18041

SPECIFICATIONS: $99.00

- 1 Printer port
- 1 Serial port : COM1 or COM3
- 1 Printer port: COM2 or COM4
- 1 Optional Serial port COM2 or COM4
- Support 4 Serial Port Address 3F8, 2F8, 2E8 and 5 interrupts: IRQ 3, 4, 5, 7, 9
- Support 3 Printer Port Address 3BC, 378, 278 and 2 interrupts: IRQ 5 or IRQ 7
- All ports can be disabled independently

POLARISED PCB SOCKET SHELL

- Tough nylon insulators, 6 way polarised to mate with P91000
- No crimp contacts



Cat No. P91002

$2.95

POLARISED CRIMP CONTACTS

- Bandoliers of 10, Tin plated brass
- Will accept 0.5 - 1.5mm wires

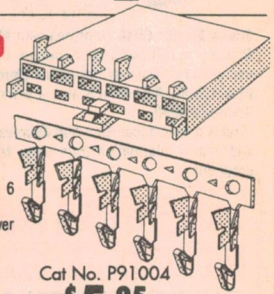
Cat No. P91003

$2.95

POLARISED PCB SOCKETS AND CONTACTS

- T6 way socket with 6 contact Bandoliers

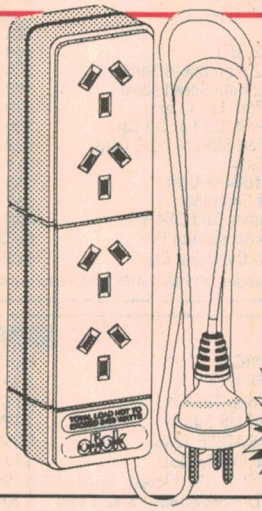
Suitable for computer power supplies



Cat No. P91004

$5.95

VERTICAL POWERBOARD



This revolutionary new powerboard design has 4 vertically placed plugs outlets. Comes with power overload protection.

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P18021

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A MUST-HAVE PRODUCT!

Does your shed/workshop resemble a tornado-striked disaster area? Well, with this nifty toolrack there's no excuse! Simply screw it on to any wood frame and finding the right tool becomes kid's play.

Has different sized-holes/slots to fit any tools that you may have in your shed.

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610L x 150W mm

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A new red-hot item. Perfect addition for the electronic workshop. Features include:

- Heating temperature of up to 319 degrees Celsius.
- PTC (Positive Temperature Co-efficient)controlled to maintain consistent tip temperature.
- Fast warmup time.
- Heating temperature of up to 319 degrees Celsius.
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Solder Station plugs into any 240VAC/50Hz mains socket to operate. The soldering iron functions at 12-18VAC 6W.

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Budget-priced soldering iron. Features include:

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- 30 watt power.
- Lightweight design for high work rate & productivity.
- Long tip life - replaceable.
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This is a true 486 machine, not a 486SX machine sold by "The Big Stores". What you get from our system is the latest technology and the most complete bundle you will ever find. Don't settle for anything less than fast graphics & superb sound system! 486DX4-100 upgradable motherboard fitted.

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- 2 high speed serial ports fitted on VESA I/O cards

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*AMD CPU. Without Asterisk- INTEL CPU

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All systems include 212 MEG Hard Disk •4 MEG RAM•101 Keyboard •14" SUPER VGA (1024 X 768) (0.28" DOT PITCH) Colour Monitor - 2 SPG Ports •1.44 MEG 3½"FDD•Mini or Baby AT casing •3 Slots VESA Local Bus Motherboard & VESA Local Bus 1MB VGA Cards are supplied in 486 machines AT NO EXTRA COST (Up to 1280 x 1024) Resolution)

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72 PIN SIMM FOR PENTIUM M.B			
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An easy do-it-yourself CD-ROM Drive & Sound System kit...Perfect addition to your new computer system configuration.

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NEW EPSON LX-300

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A 48-NOZZLE INKJET PRINTER

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PCW31894

Construction Project:

5KW DC MOTOR SPEED CONTROLLER

Here's a relatively simple, but reliable electronic speed controller for DC motors running from voltages up to 50V. The author developed it to control the motor of an electric wheelchair, but it could be used to control any similar kind of motor. The design can also be scaled up or down, to suit larger or smaller motors.

by RON BADMAN, ZL1AI

When a colleague recently built a high powered wheelchair for his handicapped wife to negotiate their beach-house property, I agreed to provide the motor speed control electronics for it. This article describes the simple and inexpensive DC motor speed controller which resulted, and which will comfortably handle up to five kilowatts using chopper techniques. The total cost of parts used in the controller itself is about A$35.

The wheelchair concerned is a four wheeled machine, with drive to the rear wheels via a high mounted differential and chain drives. The steering uses handlebars coupled to tie rods on the front wheels. Power was provided by four aircraft type gel cell batteries, giving 50 volts at a very high current capability.

After first trying a 50 volt shunt wound motor which proved to have insufficient power, the motor selected (because it was available) was a 32 volt compound wound DC motor measuring some six inches in diameter by 10 inches long. It was labelled '1/4 horsepower', which seemed rather light for its size. We tested it at both 36 volts and at 50 volts and it proved to have more than sufficient power for the job. It had a stall current in the region of 100 amps.

Design approach

I decided to use a pulse width modulated drive to the motor, with a variable on/off ratio for speed control. Using this technique I could see no difficulty retaining the full 50 volt battery. Electric motor ratings are *average* ratings and can be exceeded substantially for short periods, provided the motor temperature remains within reasonable limits — provided also that the commutator can handle the current, and that the shaft can handle the torque.

In normal running, the wheelchair motor is operating well within its ratings, but still has the capacity to provide emergency power when required, by exceeding the (average) motor ratings for short periods.

After considering all sorts of speed regulating techniques, and discussing these with the wheelchair owner, we concluded that a simple accelerator control without speed regulation was all that was required. (i.e., the system you have in a normal motor vehicle). I decided to start by using the ubiquitous 555 timer, in a simple astable circuit capable of varying the on/off ratio from 1% to 99% with a single potentiometer. This circuit

in fact did the job so well that I have used it unchanged in the final unit.

I chose power MOSFETs as the control elements because of the ease of driving them at high currents, and because they can be paralleled so easily, unlike bipolar transistors. I settled on the IRF640, an N-channel enhancement mode MOSFET with ratings of 18 amps continuous, 72 amps peak, and 200 volts maximum. The leads on the FETs looked so thin that I wondered how on earth they would handle these currents, but of course they did.

Each FET has an ON resistance at maximum current of 0.18 ohm, with +10 volts on the gate. I used six of these in the controller, so it will handle 108 amps continuous and 432 amps peak. The total resistance is 0.03 ohms, giving a voltage drop of 0.7 volt at 20 amps or 3.0V at 108 amps.

The circuit

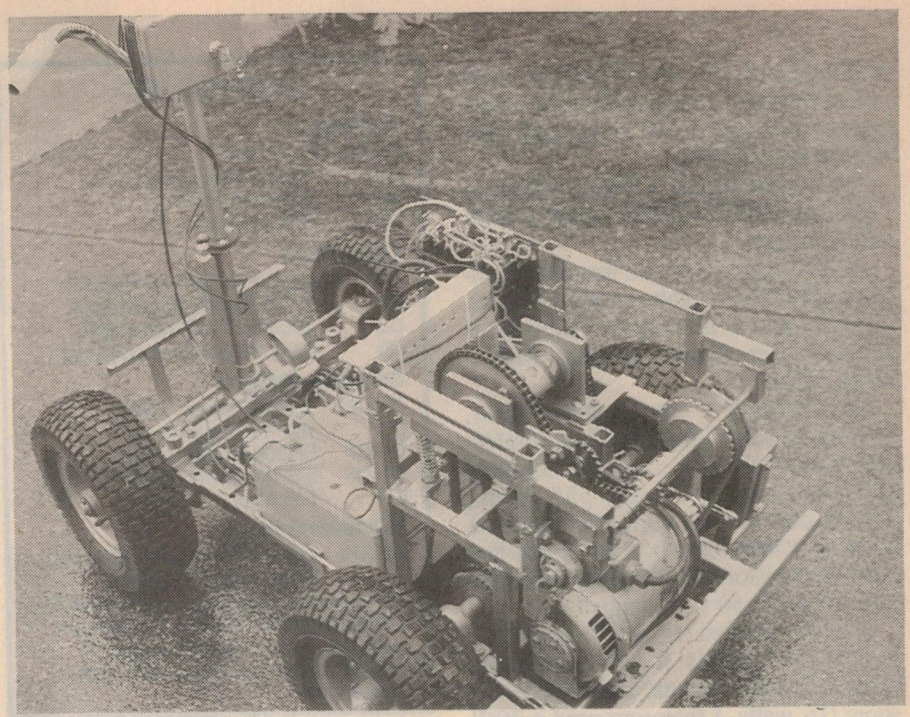
The circuit is shown in Fig.1. The speed control element RV1 is a 50k slider potentiometer, coupled to a foot activated accelerator pedal.

Capacitor C1 charges through R1, the upper section of RV1 and D1, until the voltage on pin 6 of the 555 reaches 2/3 of the pin 8 voltage. Pin 7 then pulls down to ground, and C1 discharges through D2, R2, and the lower section of RV1 until pin 2 of the 555 reaches 1/3 of the pin 8 voltage. Pin 7 then floats, and the recharge cycle starts anew. So the charging is controlled by the upper part of RV1, whereas the discharge is controlled by the lower part. Thus moving RV1 changes the on/off ratio over a very wide range, while leaving the total period (and hence the frequency) constant. The 555 drives the MOSFETs directly, with a 10 volt square wave. (10 volts is required to drive them fully on.) The 555 and MOSFETs chop the current at approximately 100Hz.

I experimented with the effect on torque of changing the frequency, and tried a circuit which increased the frequency as the pulse width increased, but found no improvement over the constant frequency. In fact, at higher frequencies the motor can emit considerable noise, whereas at 100Hz it is almost silent.

The rectifier bridge D4 - D7 is used to protect the MOSFETs and to absorb the inductive EMF from the motor when the current is interrupted. The BR358 bridge with its diodes paralleled as shown makes an inexpensive pair of diodes which can handle 100 amps peak. Two single diodes of suitable rating could of course be used.

The IRF640 MOSFETs actually have their own in-built diodes, so that strictly speaking the lower diodes on the bridge are not needed. However I feel that they provide good protection for the MOSFETs, at little cost.

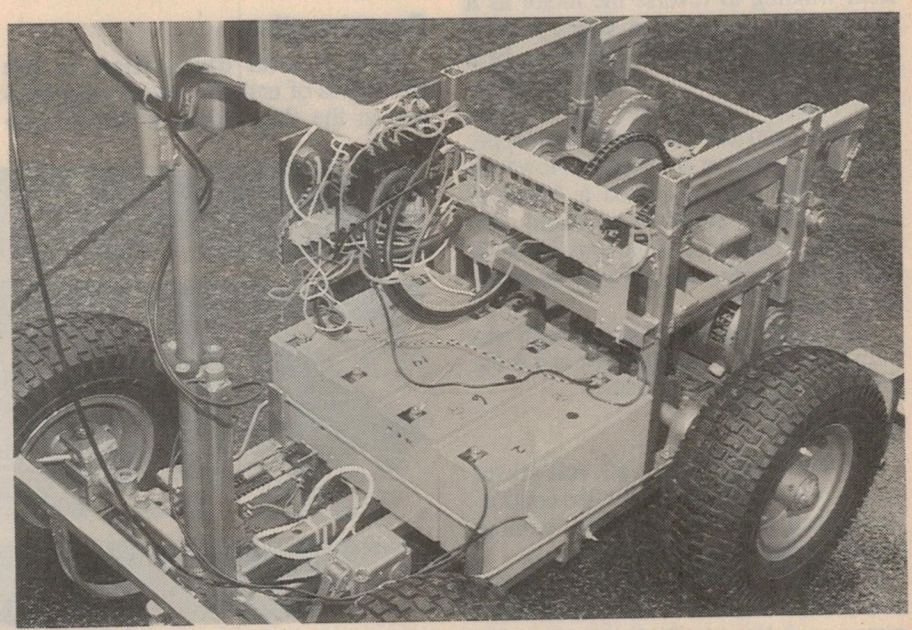


The electric wheelchair for which the author designed the speed controller described in this article, with its covers removed. The motor and drive system are mounted under the seat, with the controller module at top front.

The 10V supply

I found it more difficult than I had expected to obtain 10 volts for the 555 pulse generator. I could not use a three terminal regulator, because of their voltage limitations. Even the LM317HV, rated at 60 volts, would have been marginal, as the batteries on full charge run to some 55 volts and this voltage appears across the regulator upon switch on.

I therefore decided to use an emitter follower transistor, with its base voltage fixed by a zener diode, a technique I had used often in the days before three terminal regulators. For some reason, this circuit did not want to work with the chair controller, and promptly blew a piece off the regulator transistor. I



Another view of the wheelchair with covers removed, showing the batteries and giving a better view of the controller and fuse panel.

retaliated, after a lot of thought, with some heavier components and some bypass capacitors, to avoid any possibility of oscillation.

The controller, in a fresh offensive, blew a lead off the transistor and a track off the board!

At this stage, I decided that a more intrinsically safe 10 volt regulator was required, .and I therefore settled on a simple zener diode regulator with a series resistor.

Now I wanted to test the chair with 24, 36, and 50 volts. I therefore had to select the value of the series resistor to supply sufficient current for the 555 (about 12mA) plus a small current through the zener (I chose 12mA) at 24 volts, and both the resistor and the zener had to be able to handle 50 volts applied.

Thus R3 worked out at 630 ohms, and with a 50V supply it would dissipate some 2.5 watts, and the zener diode D3 some 0.6 watts. I therefore used a 10W resistor and a 5W zener in the prototype. You may prefer to select R3 to suit the voltage used, and so minimise heating. Determine the value from the formula:

$R = 33 \times (V-10)$

where V is the supply voltage you intend to use. Then use the nearest preferred value, e.g., if you wish to use 24 volts, the calculated value of R is 462 ohms, so you use a 470 ohm resistor.

Reversing

I made no provision for reversing the motor electronically. Being compound wound, I could not reverse the shunt field winding to reverse the motor as it would then oppose the series field. I could have placed the armature in a bridge rectifier circuit, so that the armature current was always in the same direction, and then reversed the supply voltage to reverse the motor. However, this would have required a 100-amp bridge, which would have added substantially to the cost of the unit. It would also have dropped several volts at maximum current.

The simple and practical approach was to cut the wires to the brushes and bring them out to a reversing relay.

The trial...

On the bench, with a 50 volt power supply and a 330 watt motor, the controller worked perfectly first time, without R4-R11, C5 or the dissipative beads.

However, when I installed it on the chair, with 50 volts of battery, a different motor, and long leads between motor and controller, some of the MOSFETs suddenly grew hot when the accelerator potentiometer was opened.

After fitting the additional components, a smooth control was achieved with no heating. Gradually working up to full power, I found that some minutes were required before any warmth at all could be felt in the MOSFETs or heatsink. The motor itself showed no sign of warmth after some 30 minutes of running the chair, including some heavy current use.

You may not need the dissipative beads, but I think it is a good precaution to include them.

PARTS LIST

Resistors

R1,2,4-10	1k 1/4W
R31	1.2k 5W (see text)
R11	18 ohms 1/2W
RV1	50k linear pot

Capacitors

C1	0.22uF metallised polyester
C2	0.1uF metallised polyester
C3	1000uF 16VW electrolytic
C5	0.27uF metallised polyester

Semiconductors

D1,D2	1N4148 silicon diode
D3	10V 1W zener diode
D4-D7	BR358 rectifier bridge
Q1-Q5	IRF640 power MOSFET
IC1	555 timer

Miscellaneous

B1-B14 Ferrite RF suppression beads, Philips type 020-15460

PC board, 58 x 205mm, code 94msc10; 270mm length of aluminium U channel extrusion, 76 x 38 x 4mm; length of 1.6mm copper wire; nuts, bolts, lockwashers etc.

Construction

With a total dissipation in the MOSFETs of under 20 watts when driving on the flat, I figured that a fairly simple heatsink would suffice. I decided to line the MOSFETs up side by side inside a 270mm length of 76 x 38 x 4.7mm 'U' channel of aluminium, with the 555 circuitry at one end of the channel, and all components mounted inside the channel for mechanical protection.

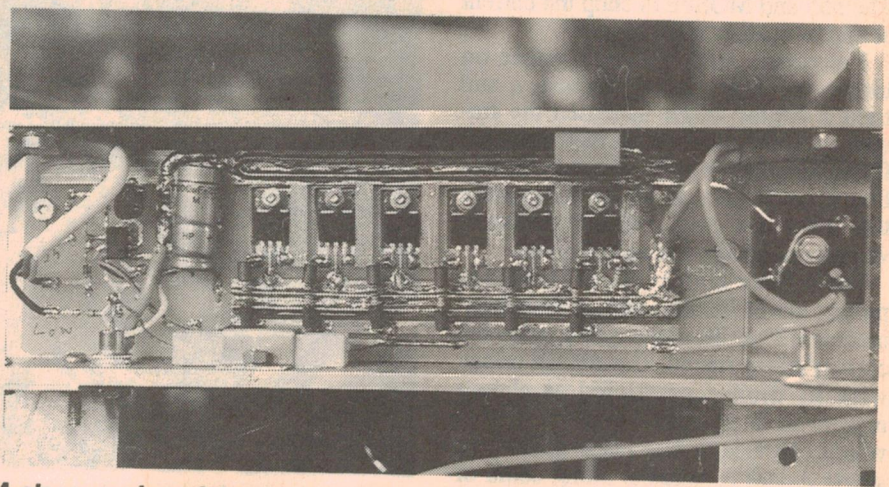
Now to carry 100 amps the main PCB tracks must be some 10mm wide, and this posed problems in laying out the board. If I mounted the MOSFETs vertically on one edge of the board, as is commonly done, their leads would not reach both tracks.

Also, because of the currents involved, I wanted to keep the leads short, rather than extend them.

I overcame these problems by running the main current carrying tracks one on each side of the FETs, and cutting rectangular holes in the PCB so that the FETs could lay flat on the aluminium surface (with insulation of course). The next difficulty was to solder the FETs in place accurately under the board so that when it was turned over and mated to the channel, the FETs would line up correctly with their mounting holes.

At this point I had the idea of making the PC board upside down, with all components on the copper side. This had several advantages: the PCB could be laid (track side up) flat on the channel without spacers, and the FETs then bolted to the channel with their leads sitting against the tracks, ready for soldering. It also meant that FETs could be replaced easily if required, without removing the PCB. All other components I surface mounted.

I used normal components, but mounted them on top of the board, bending the component leads and pins at right angles, to give good soldered connections. Because they were added later, C5 and R10 are not mounted on the board,



A close up view of the author's prototype controller — built before resistor R3 and the 10V zener diode were allowed for on the board.

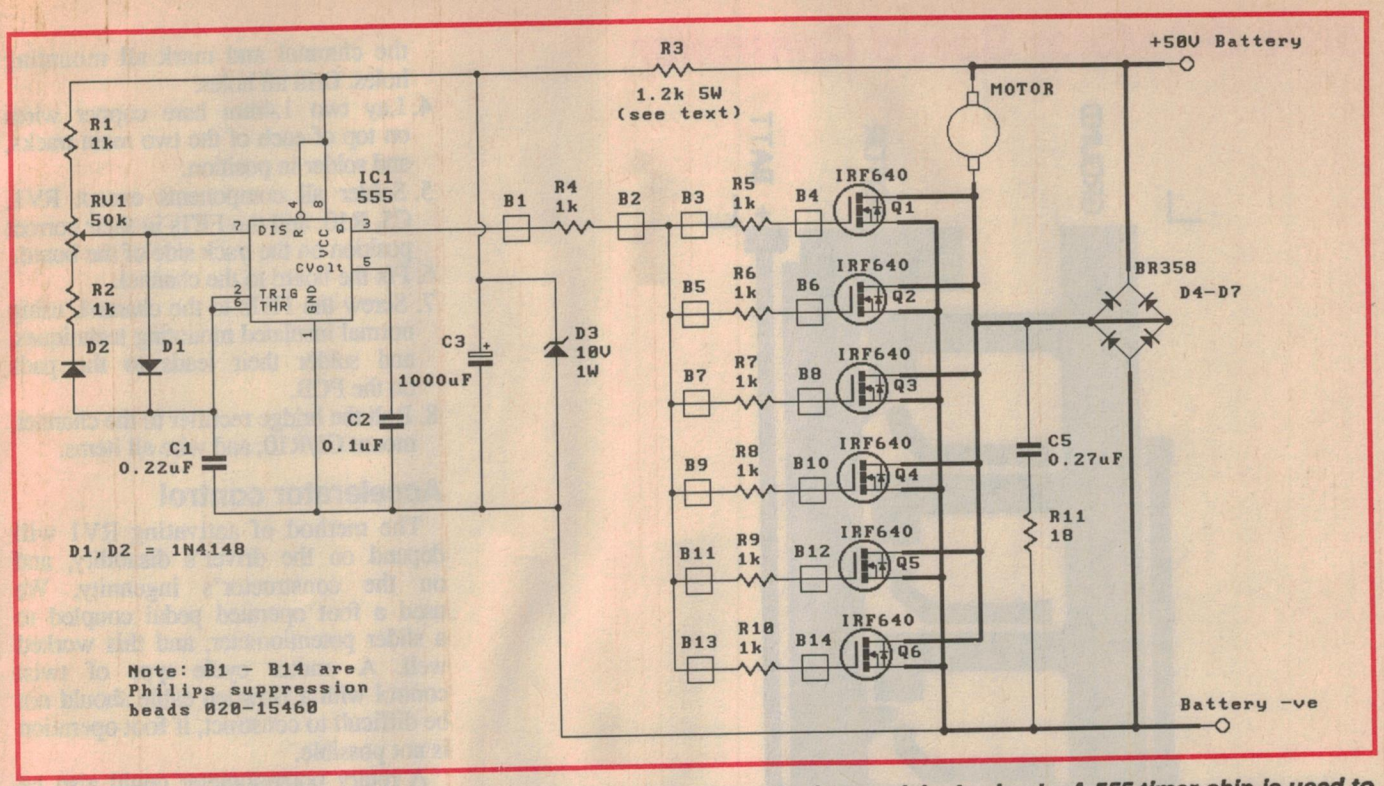


Fig.1: As you can see from the schematic, the circuit of the controller is surprisingly simple. A 555 timer chip is used to generate a 100Hz squarewave of adjustable duty cycle, and this is used for pulse-width control of six IRF 640 power MOSFETs in parallel, switching the motor current. Stopper resistors and ferrite beads are used to ensure stability.

but were wired separately, using an insulated tie point fixed to the U channel. The rectifier bridge D4-D7 is fixed to the U channel, just clear of the end of the board, to provide heat sinking.

After selecting the track widths to handle the expected currents, I decided I would like an added safety margin while experimenting, so I laid two strands of 1.6mm bare copper wire on the main tracks, and soldered them in position.

This is easy to do with the 'upside down' PCB, and it also prevents the PCB from acting as a fuse in the event of a short circuit. You should, of course, use a circuit breaker or fuse in the main supply lead to protect the controller and motor against accidental shorts.

The PCB artwork is shown full size in Fig.2, and the component layout in Fig.3. Because the component leads do not go through the board, there are no component mounting holes in the PCB. I initially mounted R3/D3 on the side of the U channel for cooling, but after revising the value of R3 as described earlier, I modified the PC board to accommodate these two components.

I did not revise the PCB after adding C5/R10, hence these remain mounted on tag strips.

You could, if you wish, extend the board to accommodate these latter components. I have included photos of the prototype, to show the general method of construction, but bear in mind that the PCB layout has been revised since the photos were taken.

Assembling the unit

Here are some points to note in connection with assembling the controller, in the recommended sequence:

1. Make sure the PCB has cut-outs in it for mounting the FETs. If it does not, you will have to drill holes of about 10 mm diameter, and then use a nibbling tool or file to shape the holes so that the FETs will fit through them.
2. Drill mounting screw holes in the PCB for screwing it to the channel.
3. Lay the PCB and FETs in position on

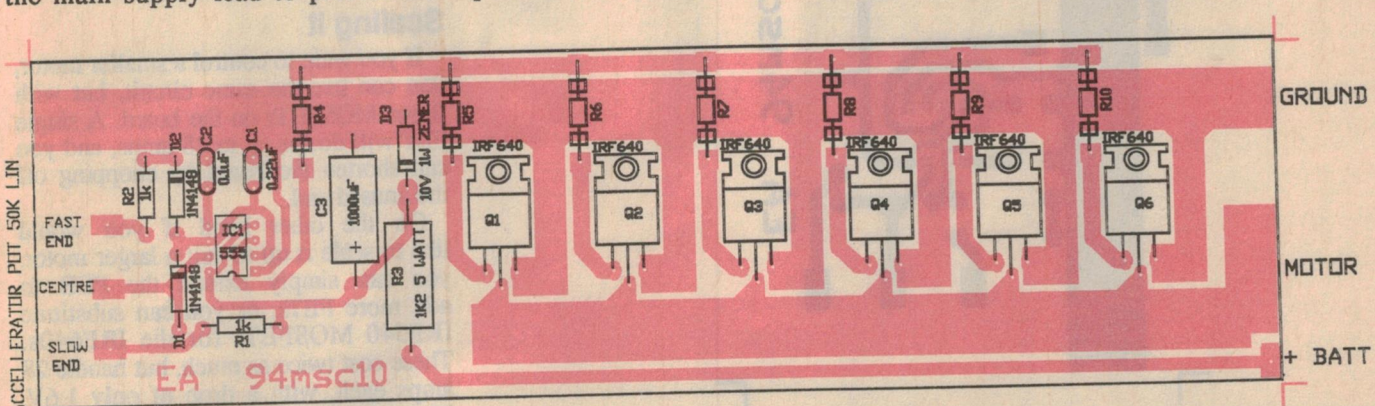


Fig.2: Here is the overlay diagram for the controller PC board, showing where all of the components go and their orientation. Snubber components C5 and R11 are mounted off the board, as is the BR358 rectifier bridge and control pot RV1.

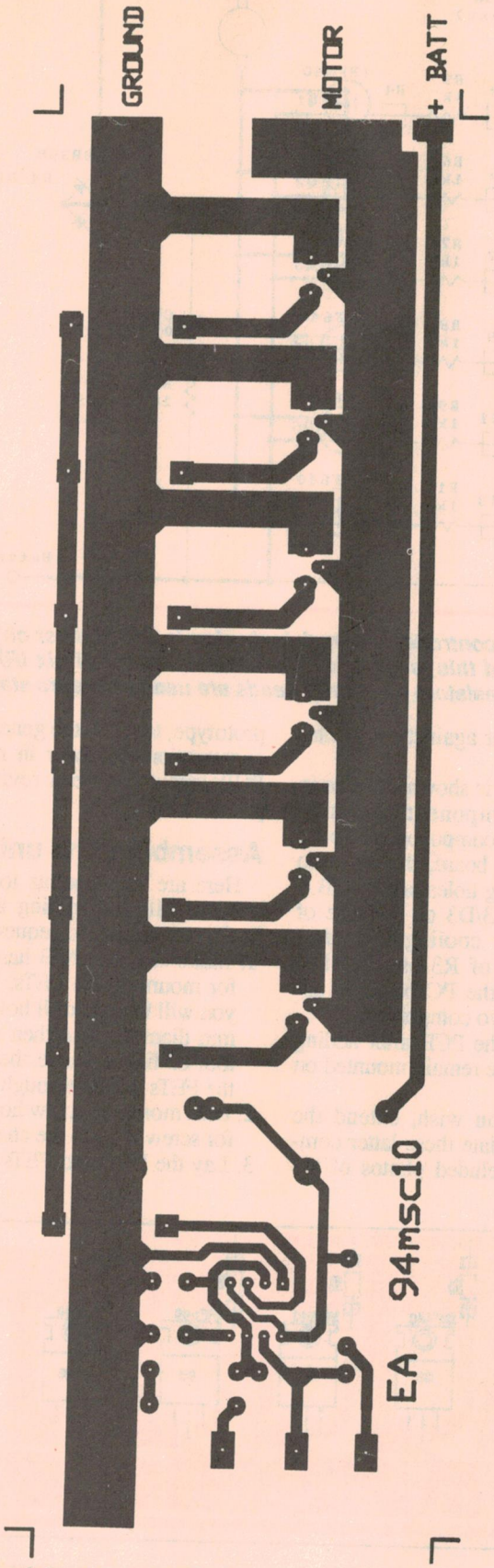


Fig.3: The artwork for the controller PC board, reproduced actual size for those who wish to etch their own boards.

the channel and mark all mounting holes. Drill all holes.

4. Lay two 1.4mm bare copper wires on top of each of the two main tracks, and solder in position.
5. Solder all components except RV1, C5, R10, and the FETs in their correct position on the track side of the board.
6. Fix the board to the channel.
7. Screw the FETs to the channel, using normal insulated mounting techniques, and solder their leads to the pads on the PCB.
8. Bolt the bridge rectifier to the channel, mount C5/R10, and wire all items.

Accelerator control

The method of activating RV1 will depend on the driver's disability, and on the constructor's ingenuity. We used a foot operated pedal coupled to a slider potentiometer, and this worked well. A motor cycle type of twist control with a Bowden cable should not be difficult to construct, if foot operation is not possible.

A rotary potentiometer could also be used, but I think the linkages would be a little more complex than for the slider type.

Performance

Control is very smooth. The chair can inch away, or if the pedal is floored, it will do 'wheelies' — lifting the front wheels clear of the ground.

At walking speed on level ground, the motor draws some 5A, and at jogging speed about 10A, rising to 25A on a hill and 45 - 100A on a steep ramp, or to lift the wheels over a substantial obstacle.

In normal use, (with dissipation in the MOSFETs under 20 watts) the heatsink runs cold. At maximum current of 100A, dissipation rises to about 300 watts, but as such use is rare and of short duration, little heating results.

Scaling it

If you want to control a smaller motor, you can use the same circuit, but with fewer MOSFETs on the board. A single FET will do for up to 18 amps, and you can shorten the board by chopping off the unused end.

On the other hand if you would like to scale it up to suit a larger motor, you can simply extend the PCB to add more FETs, or you can substitute IRF540 MOSFETs for the IRF640s. These cost twice as much, but handle 28 amps each, with a drop of only 1.6V. Thus the controller could be simply upgraded to handle 168 amps by changing the FETs... ❖

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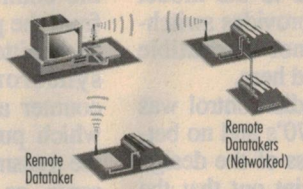

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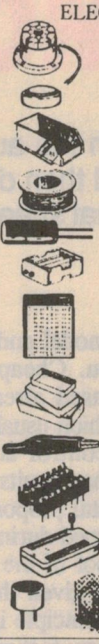

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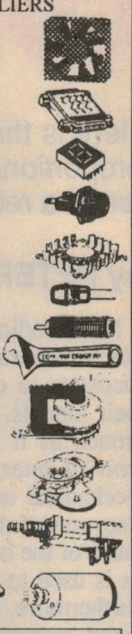

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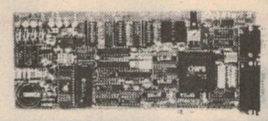

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READER INFO NO. 23

PROJECTS FOR RADIO CONTROL MODELLERS - 1

Here is the first of two articles in which the author introduces the basic concepts of modern digital proportional radio control systems, and then describes three handy projects for use with these systems: a relay driver circuit, a bidirectional speed controller and a servo signal source.

by PETER STUART, B.E., VK2BEU

Many radio control modellers use servos to operate switches, or to rotate rheostats to control electric motors, on their models. This is a cumbersome approach as it involves a double conversion of energy — from electrical to mechanical and back to electrical. It is also wasteful of electrical energy, because of the heat given off when a rheostat is used to achieve low motor speeds. Furthermore, any adjustment to suit different motors involves a rewind of the rheostat. The whole approach is also a waste of a good servo, which could be better employed for mechanical functions elsewhere in the model.

Servos are built for just one purpose: to provide mechanical movement from an electrical signal.

Armed with some knowledge about the characterisics of the electrical signal, it's not difficult to design circuits which can provide a direct conversion from the signal to any electrical function on the model, be it a switched or analog circuit.

In this article I will explain how a modern digital proportional radio control system operates, and then present circuits which can be built and connected to your R/C receiver to provide switched or variable control of electrical power.

I will assume you are using 'professional' radio control equipment, which is purchased as a separate item to your model and is fitted into the model by you. Cheaper equipment which is purchased already fitted to the model and which usually only provides switch-type control action is not compatible with the circuits presented here.

Digital proportional radio control was developed during the 1970's and no better proof of the soundness of the design can be given than to point out that the same principle is still in use today. Most R/C manufacturers use the same system, so equipment is mostly interchangeable between brands.

In simple terms, the system is designed to send up to eight channels of simultaneous control information from a transmitter to a receiver on the model, using a single radio frequency.

How it works

Fig.1 shows how it all works. An R/C (radio control) transmitter continually sends out a train of eight pulses, preceded by a synchronising pulse. Note that eight pulses are always present, even though a lesser number of channels may be fitted to the transmitter. Apart from the sync pulse which is of fixed duration (usually about 6ms), the length of the pulse of any particular channel can be varied between 1 and 2ms by the operator moving the corresponding control stick.

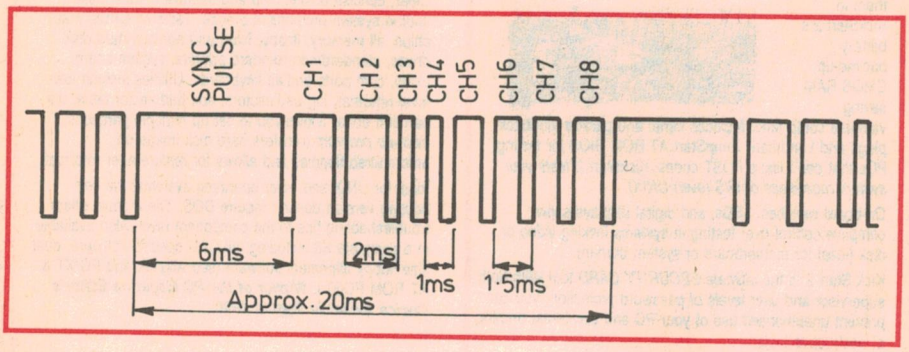


Fig.1: A typical radio control transmitted pulse train. Channels 1 and 2 are shown at 2ms duration, channels 3 and 4 are at 1ms, and channels 5 to 8 are at 1.5ms. The sync pulse is always 6ms long.

Inside the receiver, a counter is reset every time a sync pulse is received; then the counter starts counting the pulses from the pulse train. In this way both the transmitter and receiver keep in exact synchronism with each other. The counter allows the receiver to identify which pulse is currently being sent by the transmitter and send that pulse to the servo, or other device plugged into the corresponding channel ouput.

It takes approximately 18ms for a complete pulse train (or frame) to be transmitted; then it is repeated. The receiver outputs are therefore continually updated approximately 55 times per second.

Note the use of the word 'approximately'. The actual frame period can vary between 14ms and 22ms, depending upon whether all channels are set to their minimum or maximum settings. Most of the time, the control sticks are in their mid-position and the channel pulses are of 1.5ms duration, so the frame period is 18ms. For discussion purposes, this will be rounded off to 20ms.

Servos and other devices are therefore designed to respond to an input pulse of between 1ms and 2ms, repeated approximately every 20ms. The output shaft on a servo moves through an angle of 90°, starting from a fully anticlockwise position when a 1ms pulse is received and moving clockwise, with increasing pulse length, up to 90° at 2ms.

The servo will not move unless the pulse length changes; but when it does change, the servo will begin moving within 20ms. It will move to a new position within its 90° arc of travel, and the amount of rotation is proportional to the length of the input pulse in excess of 1ms. Because the motor draws current only when it is moving, servos are very economical of battery power.

Inside the servo, a timer is triggered on the leading edge of the signal pulse. The duration of the timer period is deter-

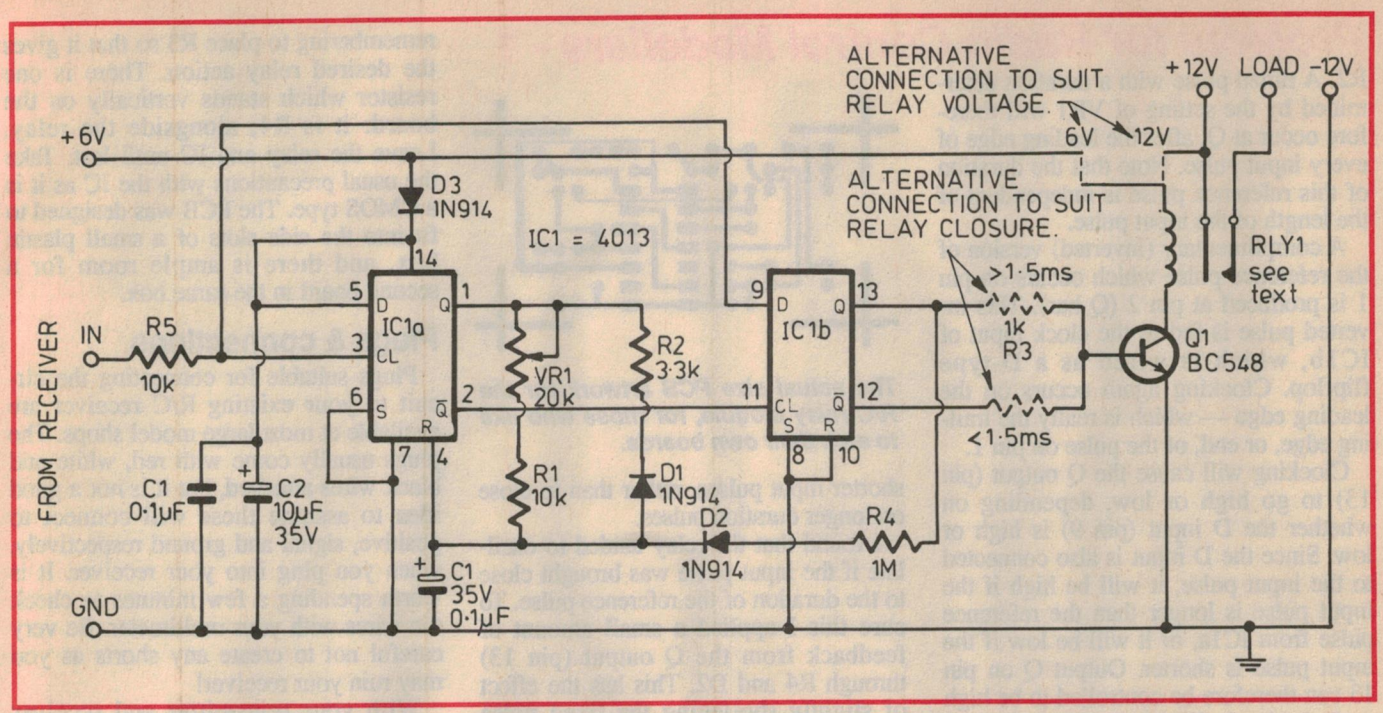


Fig.2: The circuit diagram for the radio control relay module. Note that altering the position of resistor R3 changes the relay function. The position of the wire link can be changed to suit the relay operating voltage.

mined by a pot fitted to the output shaft of the servo. Logic gates compare the duration of the signal pulse and the servo timer. If the servo is already stopped at the position required by the operator, then the pot timer period will exactly equal the signal pulse period and the servo motor will not move. However, if the operator moves the control stick to, say, increase the signal pulse length, then the logic circuits will detect the difference in time and briefly switch on the motor to rotate its output shaft clockwise.

20ms later, another signal pulse will arrive, but this time the differences in time of the two periods will be less, because the motor has rotated its output shaft pot a small amount and the servo timer period has increased. The motor will therefore be switched on for a briefer period.

This comparison will continue until the two periods are equal, at which time the motor will become stationary. If the operator moves the control stick in the other direction, the logic comparators will reverse the direction of the motor.

A great advantage of this system is that the duration of the motor switching pulses is proportional to the distance the motor must drive the servo. Thus, as the motor nears its required stopping position, the width of the pulses reduces and the motor slows proportionally. This eliminates overshoot and hunting.

A *disadvantage* is that the motor is fed with pulses at a frequency around 50Hz, which is a rather low for smooth motor running. But the end result is (surprisingly) satisfactory.

Semiconductor manufacturers have produced a number of IC's over the years designed to drive servos in the manner just described.

Some types are the NE544, SN76604 and ZN419. These contain a monostable, logic comparators and bidirectional motor drivers, all in one standard IC package.

Three circuits

Three circuits will now be described, each of which should be of interest to R/C modellers. The first two, an R/C Relay and a motor Speed Controller, are designed to plug directly into a standard R/C receiver to control circuits on the model. The third circuit is a Servo Signal Source which is a useful piece of test equipment for setting up the first two projects.

I would strongly recommend that constructors build and use the Signal Source when first powering up their new circuits, as the cost and effort involved in its construction is small compared to the risk of damage to your commercial gear. The Signal Source can also be used to test and set up servos in your model, and avoids having to fire up the transmitter and receiver whenever you wish to make a mechanical adjustment. This can be handy when others are operating models nearby and you really shouldn't be transmitting.

An R/C Relay

The circuit shown in Fig.2 is a single channel relay which can be operated from a 6V or 12V supply and which can switch currents up to one amp. It can be configured to energise the relay on a long pulse (greater than 1.5ms), or a short pulse (less than 1.5ms). The circuit uses both halves of a 4013 D-type flipflop to provide an edge triggered monostable (timer), and a D-type comparator to switch the relay.

The operation of the circuit is similar to a servo except that the monostable timer has a fixed period; it is not varied by an output shaft pot as in the case of a servo. The circuit works like this. A 1 - 2ms pulse from the receiver is fed through R5 which prevents any damage occurring to your R/C receiver should a short exist in your circuit. The signal is then applied to the clock input (pin 3) of IC1a, which is wired as a monostable.

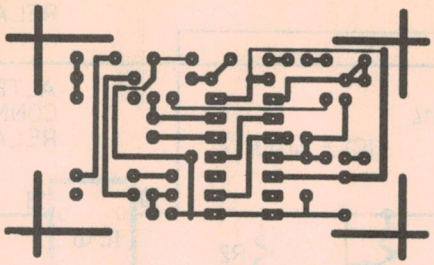
Ignore for a moment that the input signal also goes to IC1b. Because the D input (pin 5) on IC1a is permanently held high, the leading edge of the newly arrived pulse will cause output Q (pin 1) to go high and thus commence charging C1 via R1 and VR1. The capacitor will charge until its voltage has exceeded half the supply voltage, at which time the reset pin (pin 4), to which the capacitor is connected, will be triggered into operation. The reset pin will internally drive Q (pin 1) low again, rapidly discharging the capacitor through D1 and

R2. A timed pulse with a duration determined by the setting of VR1 will therefore occur at Q, after the leading edge of every input pulse. Note that the duration of this reference pulse is independent of the length of the input pulse.

A complimentary (inverted) version of the reference pulse which occurs on pin 1 is produced at pin 2 (Q bar). This inverted pulse is fed to the clock input of IC1b, which is wired as a D-type flipflop. Clocking again occurs on the leading edge — which is really the trailing edge, or end, of the pulse on pin 1.

Clocking will cause the Q output (pin 13) to go high or low, depending on whether the D input (pin 9) is high or low. Since the D input is also connected to the input pulse, it will be high if the input pulse is longer than the reference pulse from IC1a, or it will be low if the input pulse is shorter. Output Q on pin 13 can therefore be controlled to be high or low, simply by lengthening or shortening the input pulse in relation to the reference pulse.

Output Q drives the relay via R3 and transistor Q1. An alternative connection can be made to give the opposite action on the relay. Connecting R3 to the Q-bar output will cause the relay to close on shorter input pulses, rather than to close on longer duration pulses.

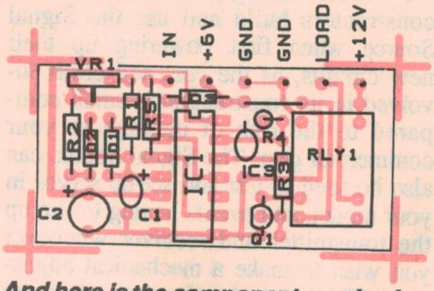


The actual size PCB artwork for the R/C relay module, for those who like to etch their own boards.

I found that the relay tended to oscillate if the input pulse was brought close to the duration of the reference pulse. To cure this I applied a small amount of feedback from the Q output (pin 13) through R4 and D2. This has the effect of slightly shortening the fixed pulse when Q is high, increasing the time gap between the two pulses, and ensuring the relay is held on. The fixed pulse will resume its normal period only when a short input pulse is received, and pin 13 goes low.

As presented, the circuit behaves as an SPST switch. It is possible to build two circuits, and by changing the connection of R3 on one, to arrange for one relay to close on increasing pulse length, and the other to close on a decreasing pulse. With suitable adjustment of the VR1 trimpots, a distinct centre-off position of the control stick can be arranged, to provide an SPDT switch action. This is handy for bidirectional control of fixed speed motors, or to provide two switch actions from one channel — although only one relay can be energised at a time, of course.

Construction should start by inserting the voltage selector link in its correct position to match the intended relay supply voltage to its coil. Next insert the PCB pins and minor components, remembering to place R3 so that it gives the desired relay action. There is one resistor which stands vertically on the board: it is R4, alongside the relay. Leave the relay and IC until last. Take the usual precautions with the IC as it is a CMOS type. The PCB was designed to fit into the side slots of a small plastic box, and there is ample room for a second board in the same box.



And here is the component overlay for the R/C relay board. Note that resistor R4 is mounted vertically.

Plugs & connections

Plugs suitable for connecting the circuit to your existing R/C receiver are available at most large model shops. The plugs usually come with red, white and black wires attached, but it is not a good idea to assume these will connect to positive, signal and ground respectively, when you plug into your receiver. It is worth spending a few minutes to check the wires with your multimeter. Be very careful not to create any shorts as you may ruin your receiver!

With your transmitter and receiver both operating, you should measure +/- 6V on the red and black wires and about 0.45 volts on the white and black wires. If you have someone helping you, they can move the control stick on the transmitter. If they move the stick corresponding to the channel you are monitoring, the 0.45V reading should rise and fall by about 0.15V. Write down the wire colours and functions for future reference, then correctly wire the plug to your relay board.

At this point the relay is ready to be tested, but I do not recommend that you test it using your R/C receiver. It is safer to build and use the Servo Signal Source which is described in the second of these articles. Adjust VR1 on the relay board to its mid position, then plug the relay board into the Signal Source and apply an external 6V or 12V battery as required, to power the relay. Movement of the control pot should result in relay action at some point over the range.

VR1 can be used to adjust the operating point of the relay to the desired position. Note that the incorporation of feedback in the circuit means some hysteresis is present, so the relay will not switch at the same point on increasing and decreasing stick movement.

The board is now ready to be fitted in its box. File a small notch in the top edge of the box to permit the signal cable to emerge when the lid is fitted. Tie a knot, or fit a cable tie to anchor the cable.

In the second of these articles, I'll describe a Speed Controller circuit and a handy Servo Signal Source.

(To be continued) ❖

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OCTOBER SPECIALS & NEW PRODUCTS

CAR ALARM SENSATION 1/2 PRICE

AMAZING SCOOP PURCHASE FROM IMPORTERS DISTRESS ALLOWS YOU TO SAVE A FORTUNE.

Road Alert RA-52 is a remote control car alarm that uses the "Volumetric" system of detection (like the new Castle Keeper House Alarm) and requires **virtually no installation**. The alarms siren (110dB) sounds **inside** the car - making it too unbearable for the theif to stay there. The RA-52 is a versatile portable alarm that can be armed / disarmed manually, or by the infrared remote control supplied.

The alarm is highly sensitive, and can sense very small air movements (volumetric). It will operate from a rechargable 9v battery, or direct from the cars power, hard wire connected or through the cigarette lighter socket. All leads supplied.

This is a unique car alarm, that works extremely well, and is an ideal investement to help "Keep Your Car".

Whats more, due to our scoop purchase the price is far below normal. The retail price of these is normally $179.

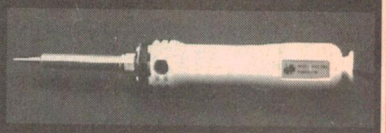
You can buy one of these now for only $89. Thats half price. A very low price for peace of mind!

Cat. LA-8950 SAVE $90 **ONLY $89.00**

JAYCAR SOLDERING IRONS

Jaycar Electronics is proud to announce the release of two new Jaycar soldering irons. These irons are fully electricity authority approved, and will give years of service.

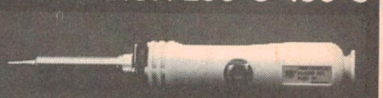
25 Watt Professional Iron NEW



This iron has its temperature fixed at 430°C. It is ideal for general soldering work for the professional or the hobbyist. It incorporates a new thermally balanced heating element which increases the efficiency of the iron, while reducing power consumption. It offers rapid heat up, and instant recovery, a stainless steel barrel and iron clad chrome plated long life interchangeable tip.

Cat. TS-1550 **New Low Price $29.95**

TEMPERATURE ADJUSTABLE IRON 250°C-450°C

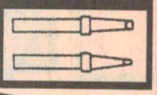


This iron is ideal if you need to reduce the tip heat when soldering delicate devices. It is phase controlled with an adjustable temperature from 250°C to 450°C. The calibrated temperature control is on the handle and ensures the right temperature for every job, every time. It also offers rapid heat up and instant recovery, stainless steel barrel and iron clad chrome plated long life interchangeable tips.

NEW

Cat. TS-1460 **New Low price $49.95**

TIPS TO SUIT BOTH IRONS - NEW LOW PRICE



1.0mm Micro Chisel Cat. TS-1552 **Now $5.95**

1.6mm Micro Chisel Cat. TS-1553 **Now $5.95**

IN / OUT THERMOMETERS WITH CLOCK - REDUCED

BRAND NEW MODEL WITH THE TIME AND ITS LESS THAN $20.

It displays indoor temp, outdoor temp, time with month and date. Measuring range of -50°C to +50°C. There are 2 temp sensors, one inside the unit, the other on the end of a 3m cable with adhesive surface for outdoor temp. Size: 86(H)x76(W)x44(D)mm.

Our old model was selling for $24.95

Cat. XC-0125 **Only $19.95**

INDOOR DIGITAL THERMOMETER

Instantly tell the temperature indoors. This thermometer has an inbuilt sensor, and will stand on a shelf or can be wall mounted with double sided tape. Ideal for houses, cars, garages, wine cellars, glass houses, offices etc etc. Size: 60(H)x45(W)x11(D)mm.

Cat. QM-6320 **$8.95**

COUNT UP AND DOWN TIMER

This timer is really easy to use, and will count both up and down. Maximum count time is 99 minutes 59 seconds. It has an LCD display which shows the time left. There is only 4 pushbuttons to operate the unit. Counting resolution is 1 second. When timer gets to zero a buzzer sounds for 15 seconds. Interruption during counting is possible. Uses 1 x AAA battery (supplied). Size: 74 x 54 x 20mm.

Cat. XC-0145 **Only $9.95**

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DISK PRICES REDUCED AGAIN

- Lifetime Warranty
- Prices per Box of 10 Disks
- Bulk Users - Contact Our Wholesale Dept For Even Better Prices on (02) 743-5222

3.5"	DSDD	Cat XC-4736	$7.50	was $7.95
3.5"	DSHD	Cat XC-4738	$9.50	was $9.95
3.5"	DSHD*	Cat XC-4739	$9.95	was $10.95
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5.25"	DSHD	Cat XC-4732	$7.50	was $7.95
5.25"	DSHD*	Cat XC-4733	$7.95	was $9.50

* denotes "IBM FORMATTED"

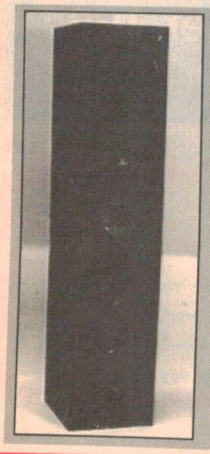
FM AUTO SEARCH POCKET RADIO

NEW

This radio receives the FM band (88-108mHz) and at the push of a button will search until it finds the next available good reception FM station. It is supplied with a set of earphones, and is ideal for walkers, joggers etc. It also has an inbuilt speaker (headphone is the antenna). The radio is quite small, measuring 95x61x18.5 mm thick. Supplied with a carrying clip. Uses 2 x AAA batteries.

Cat. AR-2215 **$17.95**

DUKE SPEAKER KITS



Refer Electronics Australia Oct 1994

JAYCAR ARE PROUD TO ANNOUNCE THE RELEASE OF DUKE SPEAKER KITS

There are two speaker kits, the DUKE DK11 pictured on the right has a 6" bass driver and a dome tweeter. The larger kit is the DK77 which is a three way system utilizing 2 x 6" woofers, and a dome midrange and dome tweeter. Call into any Jaycar store for an audition.

"Duke Speaker Kits are very easy to assemble, and will cost you far less than fully-built systems offering equivalent performance" Quote from Electronics Australia

DK11 Kit

Speakers/crossovers - pair
Cat. CS-2520 $229
Cabinets - built - pair
Cat. CS-2522 $170
Total $399 pair

DK77 Kit

Speakers/crossovers - pair
Cat. CS-2530 $399
Cabinets - built - pair
Cat. CS-2532 $290
Total $689 pair

ITS HERE

4 ZONE DIGITAL HOME ALARM WITH DIALLER

NEW

This is the first time that Jaycar has been able to offer a truly first class commercial alarm system to the Do It Yourself home installer. The alarm is made by DSC in Canada, and features an Austel approved digital telephone dialler which has the ability to ring a friend, neighbour or a security monitoring company when triggered.

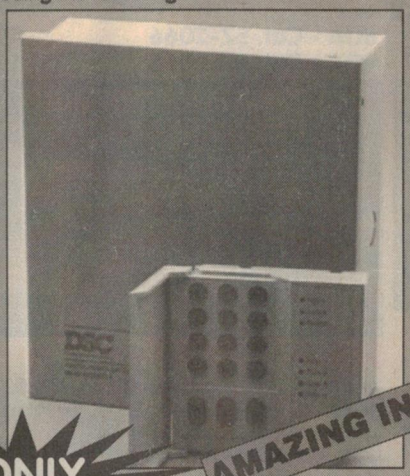
The system consists of a metal box which holds the main controller board with the incorporated dialler and battery backup. This is hidden away out of sight. The alarm is controlled and programmed by a modern design keypad, with large back lit soft touch keys and LED indicators. The keypad has 3 large panic buttons for emergencies and emits an adjustable beep each time any key is pressed.

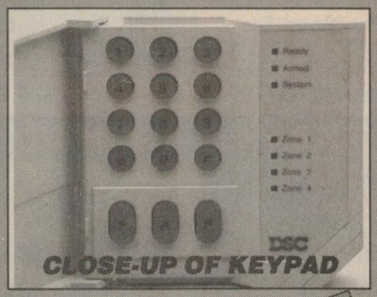
The alarm hosts a large number of features including the following.....

• a master code and three adjustable user codes •a monitor function which test features like battery backup and mains failure •four individually programmable sectors with a large array of functions available •all four sectors utilize extensive noise protection circuitry and end of line resistors for added security •once triggered, the alarm has the option of a silent alarm, and dialling a friend or monitoring compnay •quick arming option •zone bypassing for sectors which are false triggering •bell test - to test the external sirens without dialling out •door chime mode for entry / exit paths • battery backup •home or away operation •accessable alarm memory for confirming which sectors were triggered •separate instruction and installation manuals •12 months warranty •used by many commercial alarm installers

This unit is AUSTEL APPROVED (permit # A91/03/0026) and can be home connected to the telephone lines using Austel approved leads and a Mode 3 adaptor. If wiring is to be run for this, then an Austel approved installer must do this (ie Telecom). The power supply used must be an Austel approved unit with 3 wire connection, use our recommended unit Cat MP3022.

Cat. LA-5350





CLOSE-UP OF KEYPAD

OPTIONAL EXTRAS

•Power Supply - 16VAC 3 wire Cat MP3022 $24.95
•Battery Backup - 1.2A 12 volt Cat SB2480 $28.50 or
•Battery Backup - 4.0A 12 volt Cat SB2484 $34.50

ONLY $299

AMAZING INTRODUCTORY OFFER

Purchase one of the first 100 alarm panels, and we will sell you up to 2 x DSC Passive Infra Red Detectors for only $[illegible] each. These are normally worth $60 each. PIR Cat. LA-5108

LOWER PRICES ON INVERTERS

For full details see 1994 catalogue page 96.

100 Watt 12 - 240V
Cat. MI-5035 Was $134.95
Save $45.45 NOW $89.50

300 Watt 12 - 240V
Cat. MI-5040 Was $259.00
Save $60 NOW $199.50

SAVE $$$

A'Beckett St Store - Melbourne
Open Sundays 10am to 4pm

MAJIC EAR

NEW

Majic Ear is an amazing aid to hearing that sits comfortably behind your ear and magnifies sound with superb clarity. If you have trouble hearing the TV, listening to the radio etc than Majic Ear will help. With the aid of the latest micro electronics technology in Majic Ear your hearing problems can be reduced, and you won't have to pay $1,000 or more. Simply use it when you need to, and store it away in its case thats supplied. There is also 3 different earpieces so you can be assured of a perfect fit. There is an adjustable volume control and an on/off switch. Complete with battery and a spare. **Don't put up with trouble hearing!!!**

Cat. QM-7230 **only $79.50**

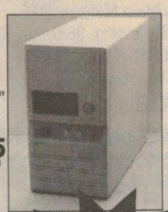
NEW COMPUTER ACCESSORIES

MINI TOWER CASE

NEW

This case includes a 200 watt power supply, and has a TURBO pushbutton, three digit display and a security keylock. It will hold two 5.25" and two 3.5" drives. Colour - fawn. Size: 178(w) x 330(h) x 400(d)mm.

Cat. XC-4635 **$99.95**



3.5" 1.44M FLOPPY DISK DRIVE

Mitsumi brand - 12 MONTHS GUARANTEE

Cat. XC-4620 **$79.95**

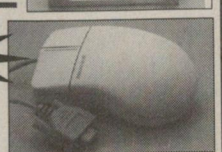
NEW

3.5" DRIVE FACE PLATE/MOUNTING BRACKET

Cat. XC-4630 **$7.95**

MICROSOFT MOUSE

NEW



Microsoft mouse gives you fingertip control and pinpoint accuracy with resolution of 400 points per square inch. This mouse outpoints them all, and has won virtually every major design and user award in the industry. The one which all others are judged by. Serial - bulk packed - with unique contoured shape that comfortably sits in the hand.

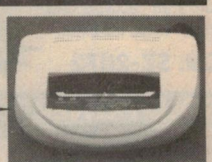
Cat. XM-5120 **ONLY $69.95**

SAVE $20 ON LAMINATOR

Laminate cards and photos to last forever!

Cat. XL-2500 Was $99.95
NOW $79.95

SAVE



Laminating Cards To Suit

Business Cards - 95 x 57mm - Pkt 100 Cat. XL-2504 **$12.95**

Photo Size - 156 x 112mm - Pkt 24 Cat. XL-2505 **$8.95**

THE LATEST KITS

KA-1764	Active Subwoofer Crossover	$69.95
KA-1763	Temperature Controller	$44.95
KC-5172	Mini VOX Voice Operated Relay	$14.95
KC-5171	Auto Nicad Discharger	$27.95
KC-5170	Twin Diversity FM Receiver	$199.00
KC-5169	LW AM Weather Receiver	$32.95
KC-5168	High Power Light Dimmer	$47.95
KC-5167	Nicad Zapper	$29.95
KC-5166	Pre-Champ Preamp	$7.95

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AUDIOPHILE CAR HI FI ACCESSORIES

GOLD POWER DISTRIBUTION BLOCK

This block will accept one 4GA wire in, and distribute to four 8GA out. Size includes mounting bracket - 63(L)x50(W) x25(H)mm

Cat. HC-4020 **$14.95**

GOLD BATTERY TERMINALS

This terminal is made from brass, and is gold plated. It has a 6mm bolt, and wing nut on which our gold terminals can be connected to run cabling to equipment.

Cat. HC-4040 **$12.95**

4 WIRE GOLD BATTERY TERMINALS

These terminals will accept two 8GA (thin) cables and two 4GA (thick) cables. One of the 4GA can be used for the existing vehicles electrical connections.

POSITIVE Cat. HC-4042 **$24.95**
NEGATIVE Cat. HC-4043 **$24.95**
CLEAR SILICON COVER FOR ABOVE
Cat. HC- 4045 **$6.95ea**

TWO WAY GOLD FUSED POWER DISTRIBUTION BLOCK

This block will accept one 4GA (thick) cable from one of 3 directions. The signal passes through fuses, then to 2 outputs for 8GA (thin) cable. Size 102(L) x 51(W) x 32(H)mm - accepts 5AG fuses - fuses extra.

Cat. SZ-2070 **$29.95**

FOUR WAY GOLD FUSED POWER DISTRIBUTION BLOCK

This block will accept three 4GA thick cables, through fuses to four 8GA outputs. Size 102(L) x 77(W) x 33(H)mm - accepts 5AG fuses - fuses are extra.

Cat. SZ-2072 **$39.95**

GOLD POWER TERMINALS

These terminals have an 8mm hole for mounting on a bolt or on our low cost battery terminal to run thick cables to equipment. Length 56mm

8GA - Cat. HC-4060 **$7.50**
4GA - Cat. HC-4062 **$8.95**

INSTALLERS

Contact our WHOLESALE DEPT for special pricing

GOLD INLINE FUSEHOLDERS

These have gold contacts and screw together. There is an "O" ring seal to keep moisture out. Total length is 112mm. Accepts 5AG fuses.

8GA - Cat. SZ-2066 **$9.95**
4GA - Cat. SZ-2068 **$9.95**

GOLD FUSEHOLDER WITH MOUNTING BRACKET

This unit has gold contacts and will accept both 8GA and 4GA cable. A mounting bracket is incorporated. Length 80mm - accepts 5AG fuses.

Cat. SZ-2060 **$12.95**

5AG GOLD FUSES

These fuses suit our fuseholders shown here. They have gold ends - and the inside conductor is also gold. Available in a range of currents. Fuse size 38(L) x 10(Dia)mm.

20A Cat. SF-1970 **30A Cat. SF-1972**
40A Cat. SF-1974 **50A Cat. SF-1976**
60A Cat. SF-1978 **All Only $2.20 ea**

CABLES

If you want your car stereo to sound fantastic, you need to use top quality cables, and this new range from Jaycar won't cost you an arm or leg.

SHIELDED AUDIO CABLES

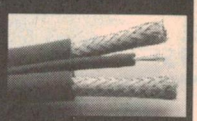
SINGLE CORE OFC TWIN SHIELDED

High quality OFC mono audio cable, double screened for extra shielding. Ideal for making your own RCA leads etc.

Specifications:
•Conductor Material: OFC •Insulation Material: PPE •Stranding: 45/0.12mm •Braid Stranding: 96/0.10 + Alum •Conductor Resistance: 0.0365Ω/M •Capacitance: 66.8pf/1M •Impedance: 65Ω@1m •Colour: Black

BLACK CAT. WB-1508
$1.75 per METRE $140 per 100M ROLL

FIGURE 8 OFC TRIPLE SHIELDED WITH CENTRAL LEAD WIRE NEW



This cable is ideal for running audio line level cables from one end of the car to the other. The triple shielding shields just about all interfaces and is the recommended cable installers use. The central lead wire is used to remotely turn amplifiers on from the tape deck/CD player.

Specifications:
•Conductor Material: OFC •Insulation Material: PPE •Stranding: 45/0.12mm •Braid Stranding: 16 x 6/0.12mm •Conductor Resistance: 0.0366Ω/N @ 20°C •Capcitance: 67.0pf/1M •Impedance: 65Ω @ 1mHz

RED CAT. WB-1509
$3.50 per METRE $250 per 100M ROLL

WIRE SIZES

4GA - Outside dia of 10mm - actual cable is 20mm²
8GA - Outside dia of 6mm - actual cable is 8mm²

OFC SUPER FLAT SPEAKER CABLE

If you thought our Monitor OFC Speaker cable (cat WB1735 $3.95m) was flat, then check this out. It will hardly be noticed under carpet and its specifications are excellent. Beware of other cables that may look the same but have less copper and poorer specs. Specifications:
•Conductor Material: OFC •Insulation Material: PVC •Stranding: 7 x 48/0.10mm •Wire Diameter: 7 x 0.85mm •Outside Diameter: 11 x 2 x 11 •Conductor Resistance: 0.00821Ω/M @ 20°C •Capcitance: 20.2pf/1M •Inductance: 0.72uH/M @ 1kHz •Attenuation (db/100m): 50Hz - 0.6, 1kHz - 0.28, 20kHz - 10.38

CAT. WB-1738
$5.95 per METRE $450 per 100M ROLL

8GA OFC HIGH CURRENT POWER CABLE

Available in red & black. If you don't require the enormous 4GA cable, then use this for your amps etc. Specifications:
•Conductor Material: OFC •Insulation Material: PVC •Stranding: 7 x 95/0.12mm •Wire Diameter: 4.05mm •Total Diameter: 6.5mm •Current Capacity: 56A •Resistance @ 20°C: 0.00252Ω/M•Conductivity: 98%

RED Cat. WH-3060 **BLACK CAT. WH-3062**
$2.95/METRE (per colour) **$220/100M ROLL**

4GA OFC SUPER HIGH CURRENT POWER CABLE

Run this from your battery to distribution boxes and then the 8GA to amps etc. Specifications:
•Conductor Material: OFC •Insulation Material: PVC •Stranding: 7 x 7 x 34/0.127mm •Wire Diameter: 7.7mm •Total Diameter: 10mm •Current Capacity: 110A •Resistance @ 20°C: 0.00097Ω/M •Conductivity: 98% up

RED Cat. WH-3064 **BLACK CAT. WH-3066**
$7.95/METRE (per colour) **$325/50M ROLL**

GOLD CRIMP CABLE TERMINALS

SMALL EYE TERMINALS

Hole size - 3.7mm. Cable hole diameter - 4.8mm. Length including cover - 35mm. Metal thickness 1mm.

RED Cat. PT-4550 **$1.00**
BLACK Cat. PT-4551 **$1.00**

LARGE EYE TERMINALS - 8GA

SUITS THINNER CABLE (8GA) Hole size - 8.4mm. Cable hole dia - 4.8mm. Length including cover - 42mm. Metal thickness 1.0mm.

RED Cat. PT-4552 **$1.25**
BLACK Cat. PT-4553 **$1.25**

LARGE EYE TERMINALS - 4GA

SUITS LARGE CABLE (4GA) Hole size - 8.4mm. Cable hole dia 8mm. Length inc cover 50mm. Metal thickness 1.5mm

RED Cat. PT-4554 **$2.00**
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FORKED SPADE TERMINALS

SUITS THINNER CABLE (8GA) Hole size 3.7mm. Cable hole dia 4.8mm. Length inc cover - 33mm. Metal thickness 1.0mm.

RED Cat. PT-4556 **$1.00**
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GOLD SPADE QC LUGS

Standard quick connect lugs that fit speaker terminals etc. Cable hole diameter - 3.7mm.

RED Cat. PT-4558 **$0.65**
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CASTLE KEEPER HOUSE ALARM

NEW GENERATION TECHNOLOGY

MICROPROCESSOR CONTROLLED | **"VOLUMETRIC"**

This alarm is almost too good to be true!!! Totally different from conventional alarm technology. The Castle Keeper is a home alarm that does not require PIR sensors and reed / magnets all around the house, nor is it a wireless system that requires batteries to be replaced all the time.

How Does It Work?

When you think about it, you will realise that the amount of air (a mixture of relatively heavy oxygen & nitrogen gases) in all the rooms of your house represents a considerable mass and volume. This volume / mass remains in a fairly static state not withstanding the slow-changing barometric pressure. If a door or window is opened, a small, low frequency - but still significant "pulse" reverberates through the enclosed air mass. The Castle Keeper works by utilizing a unique sensor that detects this pulse. Detecting the pulse is one thing, doing something about it is another. The Castle Keeper has a highly refined computer program that oversees the operation of the inbuilt microprocessor. This "intelligent" program overrides the sensor input when "signature " pulses such as those from air conditioners, pets - even draughts occur. The unique signature of windows or doors being opened is, however recognised and the alarm circuit is tripped and the Castle Keepers internal high powered siren is operated. It works, and it works well, and false triggering is remarkably low - thanks to the very sophisticated computer algorithms.

The principle of this system is known as "volumetric". If this is the first you have heard of the term, it certainly won't be your last. Volumetric is the way that home alarm technology will go in the future.

The Castle Keeper is the easiest home alarm to install we have ever sold. There are no wires to run anywhere in the standard installation. Anybody can install one. It simply plugs into a power point (with the optional AC adaptor) and it can be mounted on a wall or simply sit on a shelf.

What Extras Can be Connected?

We repeat, the Castle Keeper is designed to be a stand alone. For added protection however, you can connect some other devices. Castle Keeper has an input for a passive infra red detector. More than one PIR can be connected in parallel. There is an output for a 12V siren, which can be mounted outside the house in a box if required. The unit will also accept a backup battery inside, in case the power is turned off.

Other Features:

Castle Keeper is programmable. You can put your own 4 digit code to arm/disarm the system as well as adjustable entry/exit times. Designed for use in houses, home units, flats, even garages, boats and sheds etc.

Take it with you if you move!

If you rent premises, the Castle Keeper is ideal. There is no installation required, so when you move, you simply take it with you.

Price!

The Castle Keeper is priced way below other alarm systems. Because of its simplicity and lack of requirement of PIR's everywhere, cabling etc.

Specifications

Type:	Volumetric pressure sensor
Power Supply:	240V via 16VAC adaptor
Backup Battery:	12V 1.2Ah sealed lead acid battery
Dimensions:	230(H) x 260(W) x 80(D)mm
Case Construction:	ABS
Operation:	Digital keypad
Sensitivity:	Self levelling via intelligent dedicated processor
Entry Time:	Programmable
Internal Sounder:	107dB piezo

Accessories

Power Supply:	16V AC adaptor Cat. MP3021 $24.50
Backup Battery:	1.2Ah 12V SLA. Cat. SB2480 $28.50

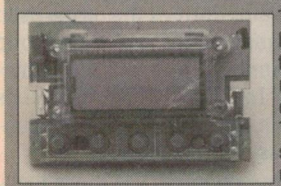
Optional Accessories:

Outdoor Siren:	12V siren. Cat. LA8908 $24.95
PIR's:	Bellmate 100 PIR. Cat. LA5016 $49.95

CAT. LA-5400

$229.50

PROGRAMMABLE LCD TIMER MODULES



NEW

These modules are basically the brains from 240V digital mains timer switches. With these you can make your own switched timers to control a myriad of devices.

There are 2 modules available - one with daily switching and one with weekly switching. Both modules have an LCD display which shows the time with AM/PM indicators. The daily unit (cat XC-0150) has 4 separate on/off periods each day. The weekly unit (cat XC-0152) has 7 separate on/off periods in 3 different zones - **1st zone**: periods 1-3 can be programmed Mon to Fri or Mon to Sat or Mon to Sun. **2nd zone**: periods 4-5 can be programmed Sat or Sat-Sun or Mon to Sat or Mon to Sun **3rd zone**: periods 6-7 can be programmed Sun or Sat-Sun.

Specifications:

•LCD display with viewing size 30 x 11mm •1.5v DC operation •50uA 1.5v output (can drive a transistor) •current consumption less than 15uA •size 56 x 36 x 10mm.

Daily Module	**Cat. XC-0150**	**$19.95**
Weekly Module	**Cat. XC-0152**	**$19.95**

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- **Port Stephens** - Port Stephens Marine Electrical Services: Lot 26 Lemon Tree Passage Rd. Saltash. Ph (049) 826 445
- **Toukley** - Technology Plus: Shop 62 Lakehaven Shop Ctr. Ph (043) 932 528
- **Tweed Heads** - Stones Sound Studio: 2/117 Wharf St. Ph (075) 364 466

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- **Echuca** - Switched On Electronics: 218 Hare St. Ph (054) 802 122

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- **Gympie** - Cooloola Electronics: Shop 4/82 Monkland St. Ph (074) 836 677
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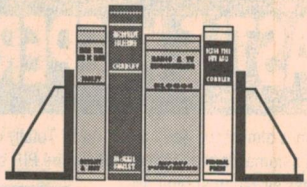
NEW BOOKS



Servicing aids

TV REMEDIES and VCR REMEDIES, published by Electronic Fault Information Library (EFIL), 1994. Two A4 volumes, each about 11mm thick. Price $95 each or $169 the two.

We reviewed the first editions of these servicing manuals in the December 1993 issue, and at the time found them both not only well produced, but also potentially of great value to the domestic electronics service technician — especially those who are just starting out. We're publishing this small follow-up review because the new 1994 editions build upon those we first saw, in various ways.

For a start, the new editions provide significantly larger databases of faults and their remedies. Taken together, the two now provide information on some 8680 TV and VCR faults and their remedies, for 28 brands of CTV and 23 brands of VCR. The cross-reference charts have also been expanded and improved, and now number 40. So all in all, the new editions provide quite a lot more information — and also seem to be rather more 'friendly' and easy to use.

If that wasn't enough, the pricing structure has also changed and dropped, to make them much more accessible. Originally the manuals were being sold on an 'annual subscription' basis, for $250 per year; now they're being sold in the usual way, for only $95 each or $169 for the two. To make them even more accessible, students of accredited trade courses get a further discount of 25%...

All of which should make them much more attractive and cost-effective than before, and very useful servicing aids.

The manuals are only available directly from EFIL, at 34 Mandalay Road (PO Box 969), Airlie Beach, Qld 4802; phone (079) 46 5690, or fax (079) 46 7465. (J.R.)

RF circuit guide

MASTERING RADIO FREQUENCY CIRCUITS Through Projects and Experiments, by Joseph J. Carr. Published by Tab Books (McGraw-Hill), 1994. Soft covers, 233 x 188mm, 411 pages. ISBN 0-07-011065-4. RRP $39.95.

Part of the Tab Books 'Mastering Electronics' series, this one is by well known US electronics writer and radio amateur Joseph Carr K4IPV. And not surprisingly, in view of Mr Carr's great interest in higher frequencies, it's a down-to-earth introduction to the mysteries of RF circuitry. As the second part of the title suggests, it's also very *practical* in orientation — with the emphasis on building, testing and experimenting.

That doesn't mean that there isn't any theory, or help for the reader who wants to know 'why'. On the contrary, there's quite a lot of sound basic theory, along with the practical stuff. This should make it of value not just to hobbyists and hams, but also to students doing communications-type courses at college or uni.

In scope it progresses from introductory material on RF circuit and component behaviour, through to practical construction projects based on both discrete parts and IC's. And although written primarily for the US reader, most of the projects use parts that are available here as well (although not necessarily with equal ease). The main exceptions are the projects on test instruments, in the last chapter, which use modules or kits from US suppliers.

On the whole, though, an excellent book on basic RF techniques and at quite a reasonable price. The review copy came from McGraw-Hill Australia, of 4 Barcoo Street, Roseville 2069; phone (02) 417 4288. (J.R.)

Managing electronics

MANAGEMENT OF ELECTRONICS ASSEMBLY, by Ian Oakes. Published by Butterworth-Heinemann, 1992. Soft cover, 190 x 245mm, 179 pages. ISBN 0-7506 0071 3. RRP $85.

The roles of design engineer and business manager are often difficult to separate, especially in a small to medium size company involved in electronics manufacture. This book is for those involved in electronic design, manufacture and assembly, either in a managing or engineering role — by dealing with both technical concepts and those of good business practice.

The first chapter defines the terms used in financial management, and the second deals with planning. It discusses strategies like Just In Time (JIT), Materials Resource Planning (MRP), quality control and process optimisation.

The remaining chapters are more technical, although you won't see Ohm's law, or any equations for that matter. Chapter 3 is about component technologies, including (of course) surface mount. Chapter 4 discusses the role of CAD and computer simulation and gives some of the finer, but very practical points of PCB layout. The remaining four chapters cover assembly products, soldering, testing and computer integrated manufacturing (CIM).

The book is very practical, and smacks of an author experienced in both design engineering and business management. The no-nonsense but approachable writing style is appropriate to the subject matter and topics are dealt with in a brief but non-trivial way.

The review copy came from Butterworth-Heinemann, PO Box 345, North Ryde 2113. It should be available from technical and larger bookshops. (P.P.) ❖

TECHNICAL AND HOBBYIST BOOKS

from TAB/McGraw-Hill

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Glass ISBN: 0-8306-2970-X $34.95

Practical solutions to TV reception problems. This book describes the three basic reception set-ups used for sending signals to TV sets and helps you solve difficult reception problems as well as important tips on safety. 202 pages.

MAINTAINING AND REPAIRING VCRs, 3rd edn BESTSELLER
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Completely updated and expanded to include state-of-the-art VCR technology and troubleshooting techniques, here is all the professional guidance you need to service and repair VCRs quickly and easily. Packed with helpful pinout diagrams and exploded view photos. 520 pages.

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Davidson ISBN: 0-8306-3893-8 $49.95

Homer Davidson ran his own repair shop for 38 years. Packed with examples, photos and diagrams for every kind of TV circuit, he helps you find and fix almost any malfunction quickly and easily. Covers HDTV, stereo sound circuitry, modular chassis and large screen models. 605 pages.

TROUBLESHOOTING AND REPAIRING CONSUMER ELECTRONICS WITHOUT A SCHEMATIC
Davidson ISBN: 0-07-015650-6 $49.95

Hundreds of illustrations and photographs show you how to locate, test and repair defective components in • audio amplifiers • car radios • cassette decks • CD players • TVs • power supplies • AM\FM receivers • and VCRs. Trade tips from an experienced repair man. 320 pages

PROJECTS

BUILD YOUR OWN LOW-COST DATA ACQUISITION AND DISPLAY DEVICES
Johnson ISBN: 0-8306-4348-6 $39.95

Turn your IBM compatible PC into a high-performance data communications system using the serial and parallel ports. Build a variety of plug-in devices for fast, effective data flow. Includes the necessary software routines, with information on data formats and rates, cabling, connectors, and troubleshooting. 320 pages.

THE ALARM, SENSOR AND SECURITY CIRCUIT COOKBOOK NEW
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Dozens of state-of-the-art circuits for security systems, condition detectors, car alarms, portable and remote alarms, piezo film and force/position detectors, and more. Also covers computer interfacing techniques. 256 pages.

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Graf ISBN: 0-8306-4301-X $38.95

Build your own audio and video transmitters, receivers, amplifiers, converters and controllers, plus a synch stabiliser and audio scrambler/descrambler. Includes plans for 16 practical communications devices. 224 pages.

All books are softcover unless otherwise indicated.
Prices and availability are subject to change without notice.

GENERAL AND REFERENCE

HANDS ON GUIDE TO OSCILLOSCOPES, h/c
Ross ISBN: 0-07-707818-7 $54.95

This excellent book covers every aspect of oscilloscope use. Describing the function of each component, it explains how each circuit works to process the signal or display the waveform required. Complete details on DSOs and trigger circuits and probes are included. 224 pages.

PRACTICAL ANTENNA HANDBOOK, 3rd edn NEW
Carr ISBN: 0-07-011105-7 $57.95

Complete instructions for building all types of transmitter and receiver antennae, including BASIC programs for design and impedance matching. Previous editions were placed in all US embassies so that communications could be restored quickly in an emergency. 528 pages.

HOW TO TEST ALMOST EVERYTHING ELECTRONIC, 3rd edn
Horn ISBN: 0-8306-4127-0 $32.95

This beginner-level guide explains how common devices such as multimeters, frequency and logic probes, signal tracers and oscilloscopes can pinpoint problems in anything from TV sets and computers to car electricals. 304 pages.

ELECTRIC MOTORS AND CONTROL TECHNIQUES, 2nd edn
Gottlieb ISBN: 0-07-024012-4 $49.95

Learn how different types of motors operate and how electronic controls can be used to improve efficiency. Covers digital stepper motors and microprocessor controls, as well as new motor and control techniques for electric vehicles. 304 pages.

THE McGRAW-HILL ILLUSTRATED ENCYCLOPEDIA OF ROBOTICS AND ARTIFICIAL INTELLIGENCE NEW
Gibilisco ISBN: 0-07-023614-3 $52.95

An introductory overview for hobbyists, students and experimenters. Contains 500 alphabetically arranged, illustrated articles, covering topics such as the use of robots and AI in the military, medicine and space. 512 pages.

TOMORROW'S WORLD: The Australian Initiative NEW
APC ISBN: 0-646-16294-2 $39.95

Lavishly illustrated in full colour, this book features over 300 Australian inventions in use around the world. They include technological advances in miniature lasers, electronic identification systems, smart cards, air traffic control, solar energy cells and many, many more. 224 pages.

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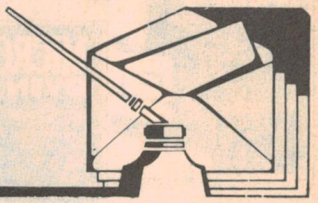


Conducted by Peter Phillips

Getting the facts right...

This month, a few points made in July are corrected by readers. We hear from 2TM's chief engineer, Peter Lankshear tells us about the Neotherm, and a charger for the ubiquitous lead-acid car battery gets a mention — at last!

Years ago, I enjoyed the status at my workplace of being the only one out of a workforce of some 400 people who knew anything about electronics. At that stage, I had yet to undertake formal training in electronics, although I was a qualified electrician with additional training as an instrument fitter. I also did quite a lot of TV and audio repair work after hours.

So my knowledge was based more on experience than theory, but compared to all others at the plant, including a raft of engineers and technicians, I was the on-site expert.

So where did this all take place? Surprisingly, in that most electrical of all electrical plants: a power station. The station had quite a lot of electronic instruments and some of the control systems were electronic, but for the most part the station was *pneumatically* controlled — making the mechanical engineer more relevant than an electronics person.

However electronics was emerging as a force to be reckoned with, and a couple of electrical engineers at the station decided to grapple with the subject. As a result, I was consulted on quite a few occasions with questions like 'what value resistor should I use in this circuit?'

From my limited experience, I would pluck a figure out of the air, knowing that it would at least get the circuit working.

Then some hours later, the engineer would return with a complex mathematical proof showing my answer to be correct.

In those days, there was a certain 'them and us' mentality — where 'them' were the engineers and 'us' the tradesmen. As you can imagine, there was considerable mileage to be gained when an engineer consulted a tradesman on a design problem. Here was boundary hopping that could not go unnoticed! The taunts would generally fall on fertile ground, and engineering staff were often at pains to prove they 'could also drill holes, not just design the drill'.

I'm reminded of all this by our first letter, which comes from a writer who is studying a mathematics major, but who is having a problem with our relatively simple February 1991 Versatile Car Burglar Alarm. As you'll read, he's not the only one, as an engineer friend of our correspondent has a solution to the problem that seems rather 'over the top'. ..

And as you'll also read, our correspondent is very aware that here is an instance of a theoretician being held up to possible ridicule by his more practical, but less qualified friends. Has nothing changed?

Car alarm problem

Eighteen months ago I built the 'Versatile Car Alarm' featured in EA February '91. It was tested in just about every conceivable way, short of setting up oscilloscopes, and was then installed in my girlfriend's Toyota Corolla.

This took ages, but after installation, I repeated the tests; all of which it passed. That is, relays triggered with the appropriate input, all time delays were correct, the ignition key disarm worked exactly as advertised and so on. However, a siren had not been connected to the siren relay at this stage.

I then fitted a siren, with inbuilt battery backup — the kind with a key to turn it off if a thief cuts the wires entering the siren. This deafening siren passed all tests (most of them conducted whilst it suffocated under a pillow).

Now to the problem: when the alarm is triggered, the siren goes off. However it can't be shut down, as the relays are 'frozen' in the latched position. Apparently the siren itself causes this to happen, as when it's disconnected and a light bulb/battery is substituted, the alarm works perfectly.

I thought perhaps the siren generates interference that gets back to the alarm circuitry, preventing it from working properly. An electronics engineer suggested I build a bandstop filter to prevent frequencies from the siren reaching the alarm circuitry. I should point out that the alarm circuit is 2-3 metres away from the siren, which is mounted under the bonnet.

But building (and designing) a bandstop filter ought to be unnecessary, as the circuit should be designed to avoid this problem. I also don't have an oscilloscope to measure the offending frequency produced by the siren.

Being a pure maths major, I also have limited time to expend on a full scale research effort into this very annoying problem. So, can you help me before I become a prime example of a 'theoretician' who 'can't do anything practical'?

Thank you for a wonderful resource: the Information Centre. I'm one of those who love to see advanced maths in it as the more advanced the maths is, the easier it is to use because of its power. (M.H., Adelaide SA.)

After my lengthy introduction, I had better be able to give a simple explanation. While I can't be sure, I think your problem has more to do with the threshold logic levels of the CMOS ICs in the circuit than interference caused by the siren.

The prototype was built using National and Motorola ICs and was fully tested, with siren. It had none of the problems you mention, but reports have come in since that some kits exhibit this type of problem.

It seems the logic level threshold

values are quite critical. Because these vary between brands of CMOS ICs, under certain circumstances incorrect operation, or even the 'lockup' you are experiencing can occur. In your case, I suspect the problem is the result of the small, but possibly significant voltage drop caused by the siren when it operates.

Two solutions come to mind: try a different brand of IC, especially Motorola or National devices, or run a separate power supply to the siren. Initially you could try powering the siren just from its backup battery, to prove the point.

If this works, it can remain our secret, and your friends will be forever impressed.

Station 2TM

Over recent issues quite a lot has been said about radio station 2TM in Tamworth, NSW. As it turns out, a letter from a reader stating that 2TM was now broadcasting on FM is not entirely true, as the next letter explains. And the writer should know; he's 2TM's Network Chief Engineer...

In July you commented on a fax received from N.F. of Stockton, regarding radio station 2TM. This station has not 'changed' to FM, but is continuing to broadcast on 1287kHz with a 2kW Harris solid state transmitter. However in 1992 our company received a supplementary licence to transmit a second program on the FM frequency of 92.9MHz.

The regulations require a completely different and separate program to be broadcast, from that by 2TM. In other words, no simulcasting. For those readers who are listeners to Hoedown, the program is also broadcast by 4WK on 963kHz and 2MO on 1080kHz.

Our FM installation consists of a Harris 5kW solid state transmitter and 1kW standby, fed by TFT 'hot standby' links and using a Jampro directional antenna system for the required pattern. Incidentally, in some very hilly locations of our service area, the FM signal is better than the AM signal. (R.G. Holley, Network Chief Engineer, 2TM Tamworth.)

It's good to get this straight, as obviously 2TM is enjoyed by quite a few readers. I hope not too many readers gave up trying to receive the station, believing the AM service was finished.

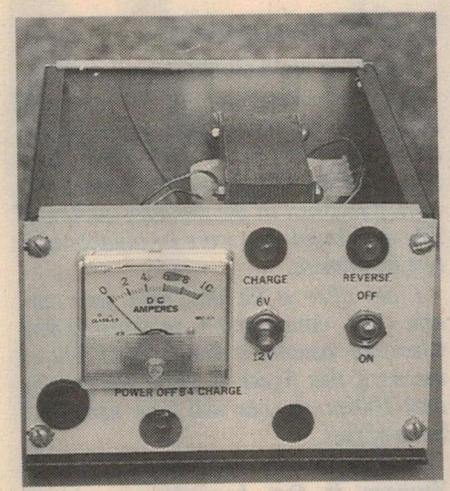
Now here's some technical information about the 2TM network, also sent to us by Mr Holley:

Our network consists of 2TM, 2AD Armidale, 2MO Gunnedah, 2RE Taree and 4WK Toowoomba, and over the past few years we have designed and built studios which we believe are state-of-the-art.

It is not easy for country stations these days. However some years ago our management had the foresight to invest in the design and manufacture of a computerised switching system, and in more recent times, digital hard disk storage.

This was achieved initially by Robert Mondel, our consultant engineer and then by Dr Jeff Pages, who is employed by this company. As a result, we can now:

1. *Switch any audio source within any studio (four standard, one production and one news studio) to any input in the station, simultaneously, and without the use of distribution amps or matrix switching.*
2. *Switch any 2UE satellite program, our news room, Hoedown studio or production facilities to 2AD, 2MO or 4WK. In fact during eastern summer time we have a fully transparent one hour delay unit, designed by Dr Pages, in the line to 4WK.*
3. *Some of our programming at night consists of feeds from satellite. This involves digital control information decoded by computer to operate our hard disk digital audio system, which introduces local advertisements, news and weather intros into the program.*
4. *Our Hoedown program feed, to 2MO at night, uses a sub-audible tone on the Telecom lines to trigger a similar digital storage system for local Gunnedah advertisements.*
5. *To run a separate advertisement schedule for the FM and AM studios we use a digital audio storage system consisting of a '486 computer with three 1.7GB hard disk drives incorporating an analog to digital conversion board designed 'in house' by Dr Pages. The audio board can do straight 16-bit conversion or give a four to one compression.*



This photo shows the revised 1971 battery charger built by F.B. of Preston, Vic.

As you may have gathered, our network is keeping up with technology and is designing everything 'in house'. In doing so, it is completely changing the work description for station technicians.

UV lamps

The next letter takes me to task about comments I made in the July column about UV lamps. They're important points, and I don't mind being put straight, as one's health is in question here!

In response to a reader's enquiry about construction of a UV light source for PCB making (EA, July 1994), you referred to a number of UV lamps that might be suitable.

Some of the information was incorrect and potentially dangerous. I refer specifically to the suggestion that lamps suitable for EPROM erasure can be used. Such lamps usually have a peak UV output at a wavelength of 254 nanometres, and are also know as germicidal lamps.

This is for good reason. These lamps are quite dangerous, will kill bacteria and can cause irreversible damage to skin and eyes, and are strongly linked to development of skin cancer.

The lamps recommended for PCB work are long wavelength UV lamps with a peak output wavelength of 320 to 400 nanometres. In fact, I understand the short-wave UV lamps (254nm) don't work effectively for exposing UV sensitive PCB coatings, anyway.

Circuit Components in Sydney, who are major suppliers of UV sensitive photo-resist boards (Riston) indicate that suitable long wave UV lamp types are Sylvania F20 T12 BL or Philips TLA 20 05. Care should still be taken to avoid exposure to these lamps as they are also harmful, but not to the same degree as shortwave UV lamps.

I think readers should be warned about the distinction between these different types of UV lamps. (G.P., Kambah, ACT.)

Fair enough G.P., and thanks for alerting us to this. As far as I'm concerned UV of any wavelength is dangerous and I assumed in my comments that regardless of the type of UV lamp, the enclosure would be light tight, preventing human contact with the UV radiation. Still, it's good to know the facts.

Battery charger

High on our list of popular projects is any type of battery charger. So, over the years we have presented many designs, mainly for NiCads, gel cells and even Gates batteries. But perhaps we've forgotten something...

I know you must get many prods from

readers wanting a special project, but I think my suggestion would have many takers.

There have been a number of designs of late for 'intelligent' battery chargers, but as far as I can see, only for NiCads and gel types (fine, I keep my burglar alarm gel cell very happy).

But surely there must be an intelligent chip, or an adaptation of it for the good old car battery? The only chargers I've seen are those designed well before intelligent IC control chips. One from EA October '71 (built and working well for a neighbour) uses at least one SCR that's unobtainable now. Another, from ETI August, required a Volkswagen headlight as part of the circuitry.

So, can an IC for a NiCad/gel-type charger be adapted to use in a charger for a car lead-acid battery, or is a dedicated IC available anyway? If so, given the ubiquity of the car battery, you'd surely have a popular design. (B.W., Thornleigh, NSW, reader since 1952).

So, perhaps we've forgotten the good old car battery in our enthusiasm to present chargers for the more esoteric cells. I'm not sure if there is a dedicated IC for a car battery charger, but given the plethora of charger type ICs, I suspect there is.

However, there are two ways I can help you, B.W. The first is, read the next letter — which fortuitously gives substitute components for those no longer available in the 1971 design you refer to.

The second is that I am now preparing an article that describes a fully automatic car battery charger. The charger is rated up to 16A, can be powered by a raw DC source (transformer, bridge and filter capacitor) or a solar panel. And it doesn't use a dedicated IC, so parts should not be a major problem in years to come.

Here's the letter about the 1971 battery charger:

I have recently constructed a lead-acid battery charger based on a project in the October 1971 issue of EA, 'An Automatic Battery Charger' by Philip Pik. This design seems to be the only fully automatic charger ever described that will come right down to a trickle current and stay there.

Unfortunately, many of the specified components are no longer available so I thought I'd send you a list of the substitutes I used. The transformer is a 18V 6A device stocked by both Jaycar and DSE. I built the unit in a Horwood case from Altronics (stock no H-0461). These might also be available from other suppliers.

Suitable substitutes for the original semiconductors are available from most parts suppliers. The substitutes I used are: C20D = C122E, C103Y = C106Y, BC108 = BC548, BZY88/C6V8 =1N4736, 35A diode bridge = MDA3504. I chose to use a 35A bridge, as a 6A bridge is likely to be overloaded if the mains comes up to 250V, as happens here.

Another idea is to delete the 6V range, as this is hardly ever used these days. Also I substituted 10mm LEDs with bezels, for the originals lamps. Perhaps you could re-run this project, as it works very well. (F.B., Preston Vic.)

Thank you for sending this information F.B., as you can see your letter is timely. But given that we are soon presenting a new design, there is no point in resurrecting the old one, despite its success.

Fuel consumption

I suppose we'd all like one of these...

Do you know of a kit I could build that measures fuel consumption in a late model motor car? I have built several of the Oxygen Sensor Testers that were published in the January edition of EA, and found they were invaluable as a test instrument.

I am after a kit that tells your current fuel consumption in litres/100km, where for instance a display of 11.5 litres means if this figure is displayed for the next 100km, the car will have used 11.5 litres of fuel.

The automotive column by Major Al Younger is fast becoming a recommended learning aid for motor mechanics, who now have to deal with complicated electronic circuitry that controls the EFI systems in modern cars. But this circuitry should make an consumption meter possible.

The device would need two inputs: speed or distance from a Hall effect generator, and a signal for injector pulse width and duty cycle. Most late model cars have an electronic speedo, which would provide one input without any extra parts. An alternative would be to count the injector pulses over 100 kilometres.

Because most late model automatic cars have a lock-up torque converter, the injector pulse count would be reasonably accurate over a certain speed in top gear.

After the injector pulses and duty cycle are calibrated to read the correct fuel consumption, the unit would allow a driver to get the best fuel economy. Apart from saving fuel, the car would produce fewer pollutants into the atmosphere. (G.B., Leopold, Vic.)

Automotive projects are nearly as popular as battery chargers, but while the principle is often simple, making an automotive project to suit all cars is virtually impossible. In fact, this objection was raised by Major Al Younger when I spoke with him about this very idea.

We presented an analog fuel consumption meter in March 1983, but parts for this project are now likely to be difficult to source. Your idea of using the existing car electronics to provide all the information to calculate fuel consumption seems logical. However, I wonder why car manufacturers haven't done this, as such a gadget would be ecologically sound, and bound to improve sales for the manufacturer who does it first.

However, it's a project we will certainly keep in mind, as it has great merit.

The Neotherm

Peter Lankshear is well known to *EA* readers from his Vintage Radio column and book. Who better to tell us more about the unknown but curious Neotherm battery, which was briefly described in Information Centre, July and September:

I see you have a query about the Neotherm battery. I guess that as vintage radio is not too far removed from vintage electrics, here goes.

Your reference books were about 20 years too young to have mention of the Neotherm. I doubt if it survived World War I. The term Neotherm, as your correspondent surmised, is derived from heat. 'Neo' is new and 'therm' is heat and the name refers to the way the battery was renewed.

There was a family of batteries pioneered about a century ago by Edison, Lalande and Chaperon which used an alkaline electrolyte (caustic soda or caustic potash) instead of the previously more common acidic types. (The modern representative of the family is the popular alkaline energiser.) These alkaline batteries were largely used for industrial purposes as they were expensive, but had a very low internal resistance with a high AH capacity and did not deteriorate when idle.

The Neotherm seems to have originated from Siemens. It was very rugged, with a cast iron case lined with copper oxide. This was the positive electrode. The negative electrode was a zinc plate in the centre of the cell surrounded by a strong solution of caustic soda. A cell 13.25 x 9.5 x 2.5 inches (337 x 241 x 64mm) had a capacity of 300 ampere hours at the two ampere rate (high even by today's standards — com-

pare that with energisers), but the voltage was only 1.1V.

In operation, the Neotherm zinc reacted with the electrolyte and was gradually eaten away. The copper oxide depolariser reacted with the hydrogen produced and was reduced to pure copper. The cell could be renewed (the Neo bit) by replacing the zinc electrode and caustic soda solution, after heating up the case in an oven. This converted the copper back to copper oxide and the cell was back to new condition.

So there you are — actually, the 19th century produced some very interesting electrics, unfortunately mostly forgotten now! (Peter Lankshear, Invercargill NZ.)

Thanks for this information, Peter. By now you will have seen the extra, but still brief, information sent to me by the original correspondent, which I included in September. What I didn't know was the need to *replace* the electrolyte and zinc electrode. Not exactly a simple task of popping it in the oven to recharge the battery, as implied by the advertisement!

So now we know about the Neotherm, a battery that seemed too good to be true. Still, it was worth investigating.

Union for electronics

In July, under the topic heading Learning Electronics, I referred to the Electrical Trades Union (ETU) as the main union looking after the concerns of those in the electronics industry. Here's a letter that gives an alternative to the ETU. The writer also asks for help about a Sanyo product, so I'll break the letter in two.

My first comment regards the mention of the Electrical Trades Union in July's Information Centre. Myself and a colleague (both electronics technicians) some time ago needed to seek the support of a union to improve our working conditions.

We found the Amalgamated Metal Workers Union (AMWU) in South Australia welcomed our membership and helped us immensely in achieving the basic award conditions. That's right! There is an award for people working in the electronics industry. I hope this may be of help to fellow technicians who find themselves in other similar predicaments.

I assume this award is for South Australia only, as I'm aware of similar awards in NSW. Unfortunately, as other readers have said, the award rate is generally very low and most employers need to improve on it to get staff. Still, it's good to know the AMWU will also look after the interests of those in electronics, if asked.

Now for part two of the letter, which is a plea for help:

Sanyo 3-in-1

I have an old Sanyo 3-in-l table top unit which seems to have a faulty output amplifier stage. I don't have a circuit diagram and am wondering if anyone might be able to help me source a circuit and a new amplifier chip.

The model number of the unit is GWT-4503K and the amplifier chip is a single-in-line 10-pin package with a metal tab, marked as LA 4220 8C5. I will pay any costs incurred. (Kerry Helman, 7 Goodall Crescent, Salisbury SA, 5108.)

What??

I have to say first up that while I can give you the answer to this question (next month of course!), I can't give you the proof. Perhaps a mathematics major (our first correspondent?) can help. Anyway, here's the question, which was sent to me by David Jones from Lethbridge Park in NSW:

Derive an expression for the total resistance between terminals A and B, in terms of R, for the infinitely long circuit in Fig.1.

Answer to September's What??

First number all the bags. Let's assume there are four, but any number is OK. So the bags are now labelled 1, 2, 3 and 4. Now take one resistor from bag 1, two resistors from bag 2, three resistors from bag 3 and four resistors from bag 4 (and so on if there are more bags). Note which bag the resistors came from.

Connect all these resistors in series. The string will contain some 10 ohm resistors and a few (from one to four) 11 ohm resistors. For four bags, there will be 10 resistors in the string. Now measure the total resistance of the string.

If the 11 ohm resistor is from bag 1, the total resistance will be -
(1x11)+(2x10)+(3x10)+(4x10)
= 101 ohms.

If it's from bag 2, you get -
(1x10)+(2x11)+(3x10)+(4x10)
= 102 ohms.

From bag 3,
(1x10)+(2x10)+(3x11)+(4x10)
= 103 ohms.

And from bag 4
(1x10)+(2x10)+(3x10)+(4x11)
= 104 ohms and so on.

Of course, any resistance values could have been chosen. ❖

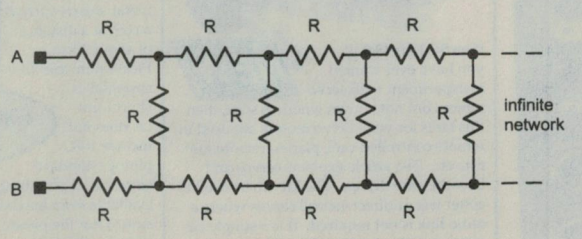


Fig.1

NOTES & ERRATA

WIDEBAND NOISE SOURCE (August 1994): It appears that with some upc1688G device combinations, and especially when conventional leaded components are used for C1-4, R1 and R2, the unit can oscillate.

If this occurs, our recommendation is to try replacing the above components with surface-mount types, mounted on the 'bottom' of the board. Then if oscillation is still present, fit an additional earthed shield plate over this side of the board, as close to the components as possible without causing short circuits. A piece of unetched PCB can be used, or a shielding box bent up from tinplate if you prefer.

In stubborn cases, a 100 ohm resistor can also be connected across the output socket.

Due to the simple design, TV signals can find their way into the unit, and this can prove a problem in areas where field strengths are relatively high. A worthwhile reduction in TV signal ingress can be achieved by bonding the supply lead earth braid directly to the metal case immediately upon entry, and also by fitting an additional ferrite bead to the +12V wire just before it connects to the PCB.

We are grateful to the R&D Department of Dick Smith Electronics for their assistance in preparing the above notes.

IMP LOUDSPEAKER TESTING SYSTEM (August 1994): In the circuit diagram shown on page 59, there are two IC12c's shown. The one between IC5 and IC1 should be designated IC11a, with its input as pin1 and the output as pin 2 — the PCB layout and overlay diagrams in the September issue are correct. ❖

Polypropylene Speakers

These fantastic speakers are ideal replacement speakers or for your own speaker design. The lightweight plastic cones offer levels of performance above that of conventional cardboard cones. The cone is more rigid and does not "break-up" (flex) as much as its counterparts.

Save 25% Phone Altronics for Full Specifications

		Watts RMS	Watts Max	Normally	This Month
C 3045	6.5" Midrange	30W	50W	$27.50	$20.50
C 3055	6.5" Woofer/Midrange	30W	50W	$29.95	$22.50
C 3060	8" Woofer	60W	100W	$59.95	$44.95
C 3065	10" Woofer	60W	100W	$79.95	$59.95
C 3070	12" Woofer	100W	150W	$99.00	$73.95
C 3075	15" Woofer	120W	200W	$139.95	$104.95

4 Piece Screwdriver Sets

Versatility with a Minimum of Tools!

These quality flat and cross blade type screwdriver sets are an ideal addition for anyone's toolbox. Sturdy design with moulded plastic handles, and incorporate finger grips. The 4 different sizes of each type make them fantastic for general purpose use.

Flat Blade Type
Contains:
1 x 6mm x 90mm
1 x 6mm x 215mm
1 x 5mm x 185mm
1 x 3mm x 135mm

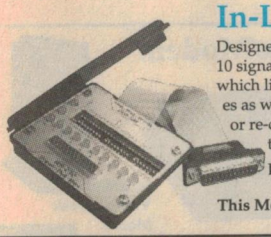
T 2190 $11.50

Cross Blade Type
Contains:
1 x 6mm x 90mm
1 x 6mm x 185mm
1 x 5mm x 155mm
1 x 3mm x 130mm

T 2192 $11.50

Bonus! Order Both the Flat and Cross Blade Sets and Receive a 6 Piece Flat Blade Jewellers Screwdriver Set Valued at $4.50

In-Line RS-232 Breakout Box



Designed for circuit testing, mounting and patching. It has 10 signal powered LED's, as well as 2 spares to indicate which lines are in use at any one time. It also has 24 switches as well as jumper leads to allow you to breakout circuits or re-configure and patch all of the 24 active lines.

Ideal for Testing & Designing Computer Wiring etc!

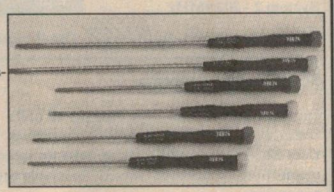
D 1540 Normally $89.95, **This Month Only $69.95**

6 Piece Screwdriver Set

Includes 3 flat blades and 3 cross head screwdrivers. The screwdrivers have long shafts which make them ideal for reaching recessed screws. Handles are made from moulded plastic, and incorporate finger grips. Shafts are made from nickel chrome molybdenum.

Sizes Included for Flat and Cross Blade Types:
2.4 x 75mm 3.0 x 100mm 3.8 x 150mm

T 2195 $10.95



Universal Testlead Set

This great set includes just about everything you would need. Supplied with 2 leads which are ready to accept a range of screw-on fittings. Includes: • 4 x Croc Clips • 2 x Fork Connectors • 2 x Pin Plugs • 2 x Hand Probes • 4 x Banana Plugs

P 0413 $6.45

Mini Bench Vice

Diecast alloy. Clamps to any surface up to 25mm thick. Jaws open to 50mm.

T 2365 $13.50

Infra-Red Movement Detector

NEW

Incorporates Pulse Count Triggering

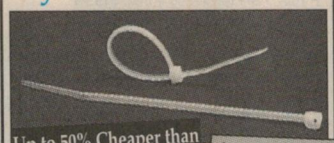
Made in Australia!

Features:
• Small size - only 65w x 80h x 45d mm • User selectable Pulse Count On-Off • Dual Element Pyroelectric Sensor • True 15m x 15m 90° angle Detection Pattern • Surface or corner mounting (Interior use only) • Wide operational voltage range 9-15V DC • Architecturally attractive • Interfaces with most alarm panels • N.C. Alarm contacts in standby condition • N.C. Tamper switch • Adjustable Beam Height Angle • User selectable walk test LED On-Off • User selectable single pulse or triple count modes • User selectable range control • Low standby current - only 15mA • Exceptional RFI and ESD immunity

Pulse Count Technology Helps Eliminate False Alarms!

S 5305 *Amazing Low* $59.95

Nylon Cable Ties



Up to 50% Cheaper than Competitors' Pricing, These are Very Strong and Long Lasting!

Amazing Offer 100mm Pack 1000 Cable Ties for Only $17.95

Strong white nylon type. Ideal for most types of electrical and electronic work. A must for any electronic enthusiast, electrician and the handy person.

100mm		
H 4010	Pk 25	$2.70
H 4012	Pk 100	$4.95
H 4014	Pk 1000	$17.95
200mm		
H 4020	Pk 25	$3.95
H 4022	Pk 100	$10.55
H 4024	Pk 1000	$59.95

24 Range Digital Multimeter

With Frequency Measurement and Capacitance Meter.

Includes frequency and capacitance ranges. With the addition of a built in logic probe and screen hold button it would have to one of the most useful DMM's available today.

This Month Receive a Free Carry Case & Protective Holster Valued at Over $28.00

Q 1035 $169.00

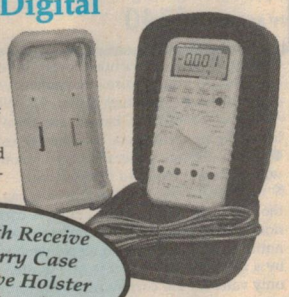
Auto Ranging 3.75 Digit Digital Multimeter

Triple LCD Display Includes 2 Digital & 1 Bar Graph.

This incredible multimeter would have to be one of the most comprehensive on the market today. It is capable of doing all the normal voltage, current and resistance readings, as well as capacitance, frequency, minimum and maximum sampling, relating measurements, storing previous readings, limit setting, signal transistor gain checking and is full auto-ranging.

This Month Receive a Free Carry Case & Protective Holster Valued at Over $28.00

Q 1038 $199.00



Diagonal Cutter

With sharp bevelled edge and rounded jaw profile. Length 113mm.

NEW

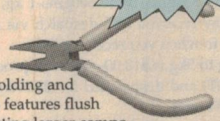
T 2753 $12.95

Mini Ball-Nose Pliers

Buy all 3 Types for $25 & Save!

Strong serrated jaws. Suitable for holding and griping. Also features flush cutters for cutting larger components. Spring loaded insulated handles.

T 2797 $8.95



Precision Pliers

General electronic use. Length: 130mm.

NEW

T 2740 $12.95

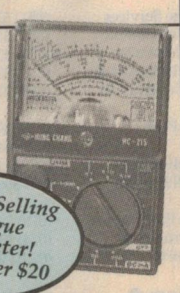
Budget Pocket Multimeter

2000 Ohms-Volt sensitivity. Overload protected. Mirror back scale helps prevent parallax error. Complete with test leads and instructions. Uses 1 x AA Battery (supplied).

Specifications:
DC Voltage Ranges: 10V, 50V, 250V, 1000V
AC Voltage Ranges: 10V, 50V, 250V, 500V
Decibels:.....10 to 22dB
DC Current Ranges:.....0.5mA, 50mA, 250mA
Resistance Ranges:.....Rx1, Rx10, Rx1k

Q 1013 Normally $21.95, **This Month $17.95**

Our Best Selling Analogue Multimeter! Now Under $20



CADIK Micro Jet Gas Blow Torch

Powered by a common disposable type gas lighter (not supplied), this unique blow torch burns at 1300°C, making it ideal for all types of braising and heavy duty soldering. With it's ergonomic design, the Micro Jet can be ignited and used simply with one hand. It has an in-built piezo electronic ignition system which ensures easy lighting every time. Ideal for the workshop, tool box, work bench etc. Suitable for Heavy Duty Soldering, Braising, Silver Soldering, hobbies, Model Construction etc.

As Reviewed by Silicon Chip Magazine May '94

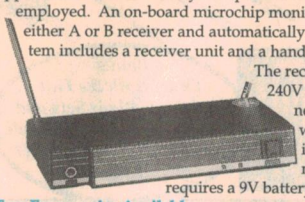
T 2490 $29.95

ALTRONIC COMPONENTS • Overnight Delivery • AUSTRALIA WIDE

✪ ALTRONICS - FAX (09) 328 3487 ✪

Wireless Diversity Microphone Systems

These professional wireless microphone systems are as used by the industry for stage and studio productions. Featuring stylish good looks and the latest microchip technology they offer outstanding performance and sound reproduction both for voice and instrumental applications. True Diversity Reception means two receivers with separate antennae are employed. An on-board microchip monitors the signal strength and reception fidelity of either A or B receiver and automatically outputs the highest quality signal. Each system includes a receiver unit and a hand held microphone.



The receiver operates from 240V AC and simply connects to an amplifier with a line level input. The microphone requires a 9V battery (not supplied).

Complete System Only $544 Save $200

Two Frequencies Available:
System 1 - 202.5MHz
System 2 - 202.9MHz

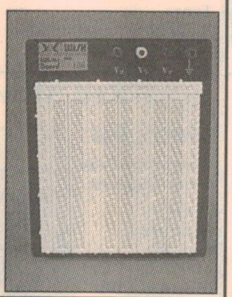
As Used by Professionals for Stage and Studio Productions!

Each System Normally $744.00, This Month Only $544 Complete System

Breadboards

Standard 0.1 inch spacings. Accepts all LSI's semis, transistors, diodes, leds and passives. Uses 22-30 gauge solid hook up wire for interconnections. Boards are "keyed" to enable easy expansion.

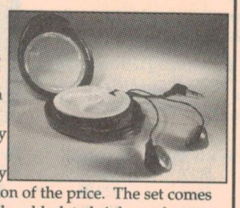
100 Holes **$4.65**
P 1005 640 Holes **$14.95**
P 1007 740 Holes (100 + 640) **$19.95**
P 1009 840 Holes (640 + 200) **$21.50**



Mounted on Aluminium base with rubber feet with binding post terminals.
P 1012 1680 Holes (1280 + 400) **$49.95**
P 1015 2420 Holes (1920 +500) **$69.95**

Receive 20m of Multi-Colour Cable Free with Each Breadboard! Ideal for Wire Links!

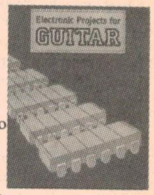
Inner Ear Phones



In our opinion, these very rugged, brilliant reproduction earphones compare very favourably with the Sony yet at a fraction of the price. The set comes complete with gold plated right angle 3.5mm plug and "wind up" carry case. Fantastic for personal stereos, video cameras etc.

C 9005 Normally $19.95, **This Month $15**

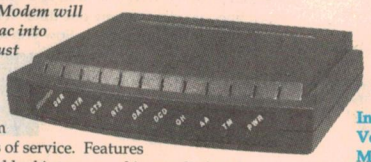
Electronic Projects for Guitars



By RA Penfold. Make your own guitar effect pedals from commonly available component. Ideal for both those who are experienced and beginners alike. It's a collection of `16 guitar and general purpose effect units. Each project has an introduction, a circuit diagram and complete instructions.

B 2230 $21.50

New Maestro External Fax/Modem



This Maestro Fax/Modem will turn your PC or Mac into a Fax machine in just minutes!

Using the latest in digital signal processing this modem will give you years of service. Features new sleek and good looking case and is supplied with Winfax software. Backed with full support by Maestro. Winfax offers some great features like sending faxes to several numbers simultaneously, viewing incoming and outgoing faxes on-screen, receiving faxes in the background while using other programs, scheduling faxes, and much more! Modem data and fax baud rate up to a speedy 14,400bps. Includes the latest hardware compression and error correction protocols.

Includes Vertical Desk Mount

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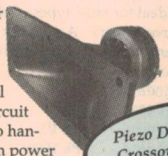

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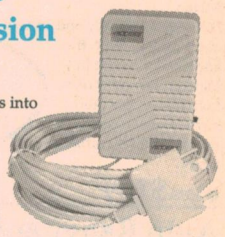

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with NICK DE VRIES MIAME, AMSAE

Exhaust gas analysers

A new contributor is taking over our Auto Electronics column from this month, as Major Al Younger has moved back to the USA. His successor is Nick de Vries, who like Major Al is highly qualified and has long experience with both cars and their burgeoning electronic systems. So without further ado, here's Nick's first informative column...

Over the past months, by courtesy of Al Younger, this column has described the electronics of engine controls and various means of diagnosing faults common to modern engine management systems. It's a hard act to follow, but this month I'm proposing to begin by looking at another specialist piece of automotive test equipment: the Exhaust Gas Analyser.

Since the invention of the horseless carriage and the infernal combustion engine late last century, (seems like the dawn of time, doesn't it?), engineers and inventors have tried to perfect and control the burning process of fossil fuels inside small dark spaces called cylinder heads. The results have been analysed on the basis of performance, driveability, fuel consumption and — more recently — pollution.

Accurate tuning needed

The importance of this latter parameter has spurred our manufacturing engineers to more accurately 'tune' the engine to the burning characteristics of the fuels in use. But out here in the real world of fault diagnosis and repairs, the dizzy heights of flame propagation, pressure waves, litres per kilowatt/hour, and the effects of combustion temperature on exhaust laden pollutants have been largely out of our sphere of measurement or control.

Enter the Exhaust Gas Analyser. During the late sixties and early seventies, combustion analysers were developed for the automotive repairer. These early attempts at making the combustion process more scrutable were based on the Wheatstone Bridge principle (see Fig.1), which basically had the exhaust gas sample pass unfiltered over a platinum wire, usually without the benefit of a pump. This produced cooling of the platinum wire to varying degrees (sorry about the pun), which changed the balance of the circuit and caused deflection of a needle to indicate percentage of combustion or air/fuel ratio (AFR).

This system certainly had its shortcomings, notably accuracy and repeatability and the fact that these analysers were painfully slow to react to engine changes. It is interesting to note, however, that the recent crop of exhaust gas analysers available today have come full circle. Things started with carbon monoxide (CO), progressed to hydrocarbons (HC) plus CO in the mid sev-

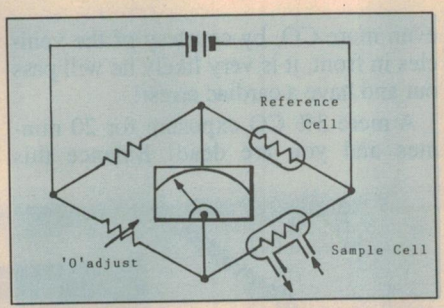

Fig.1: Early exhaust gas analysers used a platinum wire sensor in a Wheatstone bridge circuit.

enties, and then to 'four gas' analysers adding carbon dioxide (CO_2) and oxygen (O_2) in the early eighties; now they are including AFR as an important diagnostic aid again.

Air/fuel ratio

There will always be the purists of course, who will argue that the only way to measure the AFR is to measure the fuel and air going into the engine, and then calculate the ratio — and they would be absolutely right! In fact the manufacturers of today's gas analysers make no claim to measure the AFR, but calculate it based on how much oxygen is left after the burning process is over. So if there is 20.8% O_2 in the air to begin with and only 1.7% left at the tailpipe, taking into account the other gases, an algorithm or lookup chart can be used to convert the readings to AFR.

The theoretically perfect (stoichiometric) ratio of air to fuel varies depending which fuel is being used. For example with leaded petrol it's 14.7:1 — that is, 14.7 parts of air to 1 part of fuel by weight. For unleaded petrol the corresponding ratio is 14.8:1, for LPG about 15.5:1 depending on its propane/butane mix, and for CNG (compressed natural gas) it is about 16:1; more about this later.

These ratios, however, are only relevant at wide-open throttle (WOT).

Diagnosis

How then does the automotive diagnostician use his gas analyser to best effect? Having been involved in the automotive industry since 1975 and specialising in tuning since 1984, I have come to realise that the best way of diagnosing engine faults is directly from the exhaust gases themselves. In fact, I would go so far as to say that 60 to 65% of my diagnosis was based on this alone!

Although very little is available in print about this fascinating subject, there is a growing body of professionals out there who have made it their business to understand gas analysis simply by knowing what constitutes a 'good' reading — having observed vehicles without faults, and then compared them to the readings obtained from vehicles *with* faults, either introduced by them or through wear and tear.

With PC-based analysers becoming more accepted, this vast 'cerebral database' among automotive engineers is being written into gas analyser programs. This allows the new analysers to provide pass/fail levels for the readings, depending on fuel type and year model.

Hydrocarbon levels

For those of you who paid attention in science classes, it should be apparent that petrol is a hydrocarbon (HC). Therefore it follows that if any HC is present in the exhaust, it must be unburned fuel and/or oil.

Exhaust HC is usually measured in parts per million or 'ppm' rather than a percentage, as the numbers would be extremely small. Modern engines equipped with a catalytic converter in the exhaust pipe emit quite low levels of HC, around 100 to 300 ppm at idle with the engine at normal operating temperature (NOT). It soon becomes obvious however that not all measurements can be taken at the theoretically ideal engine speed and load conditions, with out of tune or faulty engines spewing out large quantities of unburnt HC.

As the vehicle ages, it becomes somewhat of a balancing act for the tuner, between acceptable levels of HC and CO on the one hand and driveability on the other. After all, however noble the owner's intentions, if the car behaves badly but smells environmentally clean, the decision to set the mixture a bit on the rich side often becomes an economic one rather than an environmental one.

Another diagnostic use for HC is testing for blown head gaskets. Placing the exhaust probe tip just inside the radiator neck, (making sure to drain off some coolant first to prevent drowning the analyser optics in ethylene glycol!), any reading of HC is an indication that exhaust gas is leaking into the cooling system.

The CO level

Carbon monoxide has long been held up as the 'adjustment' gas, reflecting the carburettor or mixture setting. What is not well understood is just how poisonous this insidious killer can be. CO has a much greater affinity for the haemoglobin in the blood stream than does oxygen, and it rapidly displaces the life-carrying ability of the blood. Not only that, but it has been found to be accumulative and typically takes 48 hours to be purged from the blood.

A situation can develop where, in a badly ventilated repair shop, the staff are exposed to high levels of CO for five days, with a rush of work on the last day of the week. As a result they end up with dangerously high blood CO concentrations. If the afflicted employee then drives home in a traffic jam and breathes

Fig.2: The new ADS 9000 four-gas engine analyser, from Australian firm Autodiagnostic Systems.

even more CO, by courtesy of the vehicles in front, it is very likely he will pass out and have a cardiac arrest!

A mere 3% CO exposure for 20 minutes and you are dead! Balance this against a typical idle mixture setting of 0.5% to 2.5%, depending on engine size and age (older engines require 'richer', i.e., higher settings) and you have some idea of the danger. I have tried to tune an ageing Daimler Conquest that refused to idle at anything less than 6% CO and 600ppm HC.

So if you're feeling lethargic after tuning cars all day, don't sit down and have a smoke — you'll only make it worse. Go outside and breathe some fresh air, while we've still got some!

Carbon dioxide

Carbon dioxide is the so-called 'greenhouse' gas that humans and animals have been breathing out for millenia. In an engine's exhaust this gas responds in an inversely proportional way to HC: when the HC is high, CO_2 is low and vice versa. Here is the dilemma for vehicle manufacturers trying to build green engines — the more efficiently the engine runs, the more CO_2 it produces.

The aim for the mechanic is to set the fuel system, whether it is a carburettor or fuel injection, to just under the maximum CO_2 the engine will produce, around 13 - 15%.

As mentioned earlier, CNG with its higher AFR of 16:1 cannot produce as much CO_2 as petrol or LPG, and the future of personal transport may lie in this direction. Imagine being able to fill up your gas tank at home from the natural gas mains, with no more queuing up at petrol stations.

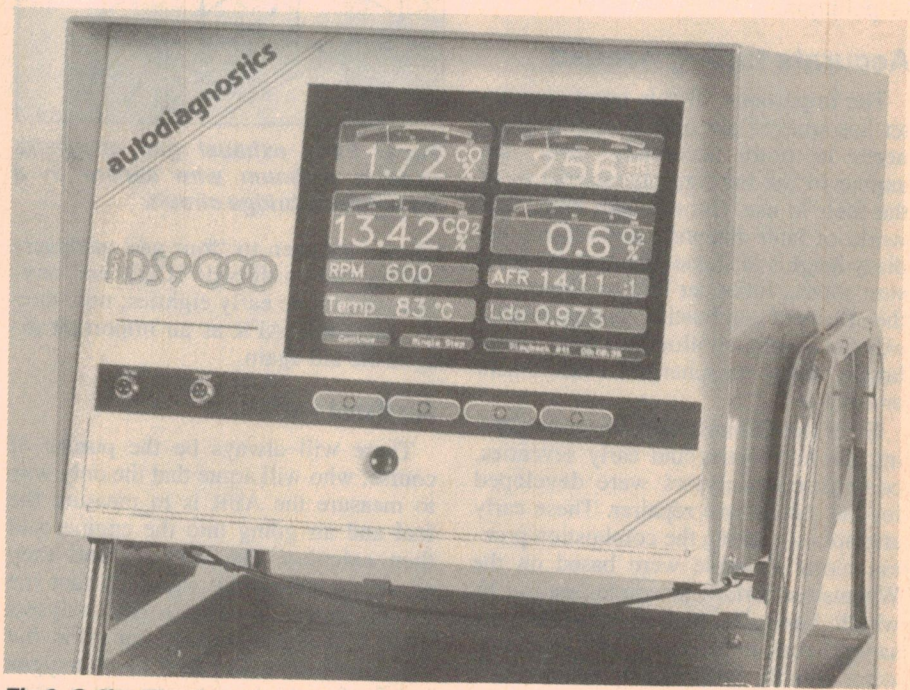

Fig.3: Self calibrating, the ADS 9000 analyser provides on-screen display of carbon monoxide and dioxide, oxygen and hydrocarbons — plus other parameters.

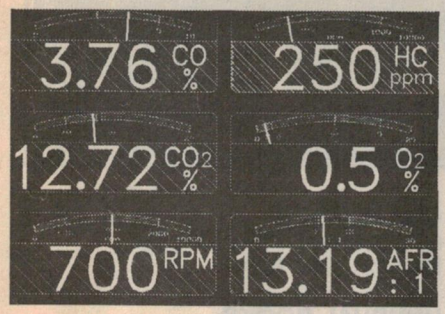

Fig.4: A set of readings for a vehicle which is bordering on illegal...

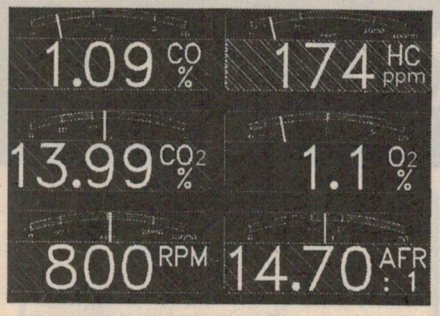

Fig.5: For comparison, a set of readings for a well-tuned engine.

Can you see the oil companies giving up without a fight? Not on your Nellie; they will use every lobby group available to slow the inevitable, while shoring up reserves of natural gas for themselves to preserve their dynasties.

Oxygen level

Now to oxygen. The absolute quantity of oxygen in the atmosphere varies slightly with temperature, but much more with humidity as the moisture content displaces it. Altitude also has a big role in determining the level of available oxygen, and some gas analysers have built in compensation for barometric pressure and therefore altitude. Others are switchable, whereas most are set by gas calibration on site with a certified bottle of 'calibration gas'.

Exhaust gas oxygen level has an interesting response curve, regardless of what fuel is being consumed. A case in point is one Australian fireplace manufacturer, Coonara International, which used an automotive gas analyser to measure the excess air factor in the flue stacks and calculate the AFR to ensure compliance to emission standards...

The usual level of exhaust O_2 in a well tuned engine is in the range of 1 - 2%. Once again this gas is indirectly proportional to CO, where a rich mixture will show a low O_2 reading and a lean mixture will typically be around 1.7 to 2%. But there are other diagnostic uses for O_2 level as well, and here is where the skill of the diagnostician comes in — and why some mechanics can charge significantly more than the also-rans.

A reading of 5% or more, usually accompanied by a high HC reading of 600ppm or more (providing there are no leaks in the exhaust system) indicates a vacuum leak either between the throttle plate and the inlet valve seat, badly seating inlet valves, or possibly unevenly worn cam lobes causing variations in valve timing.

With so many complex variables, it is easy to see why there is so little in the way of published material available. What with altitude, exhaust leaks, worn engines, and fuel quality variations, how does one write a definitive guide to gas analysis, without resorting to wide generalities and outrageous oversimplifications?

As a matter of interest, Australian company Autodiagnostic Systems is manufacturing PC-based gas analysers and tunescopes in Engadine NSW, and has stolen a march over imported equipment in many areas. The ability to record test dynamometer runs and road tests, and recall stored customer details, have put this innovative organisation at the forefront of automotive diagnostic testing.

Yours truly has been privileged to contribute some of the ideas for the company's test programs, as have many of our customers, and it's a refreshing change to be able to communicate with the manufacturer and develop a customer-driven set of test routines.

For further information call Bob Groombridge of Autodiagnostic Systems on (02) 548 1069 if you're in NSW or Queensland; Doug Webb of Fueltech on (003) 31 3518 for those in Tasmania; or myself at AutoTEST on (085) 63 0607 for SA and Victoria.

Next month, we will look at the actual workings of a modern gas analyser's optical bench, and how the 'non dispersive infra red' gas analysis system has become the automotive standard for testing purposes. ❖

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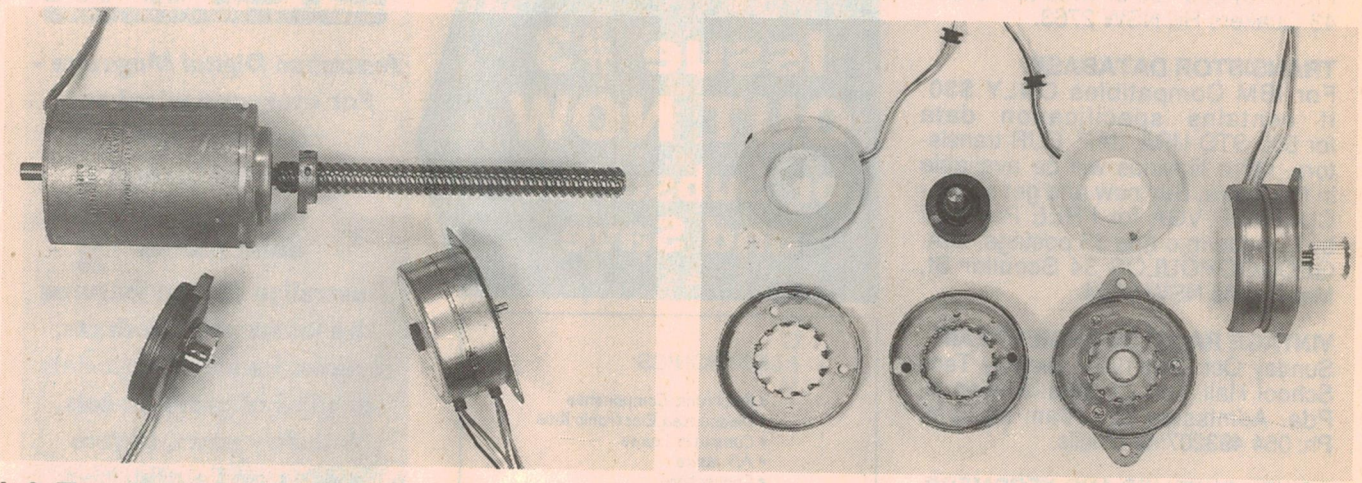
Experimenting with Electronics

by PETER PHILLIPS

Stepper motors and how they work

This month we look at stepper motors, and how they actually work. Because there are various types that can all be driven in various ways, we don't have space to get into experimental circuits until next month. Then we'll describe two circuits — one that uses a dedicated IC, the other a transistor interface to a computer.



Left: These stepper motors come from (top) an old 8" hard disk drive, (bottom left) a 5.25" IBM compatible disk drive, (bottom right) a dot matrix printer. Right: The assembled stepper motor is on the right. At the top are the two coils with the magnetised rotor in between. The stator assembly is arranged along the bottom.

Despite their widespread use, I'll bet quite a few readers don't know how stepper motors work. As you'll see, they are quite simple devices, although driving them with discrete components is not easy. Fortunately, there's an IC that does all the work.

However many stepper motors, both large and small, are driven by a microprocessor or a computer program. We can't get into programming details, but we can look at interfacing a stepper motor to a PC and explain what's needed to make it run.

In case you're wondering why you should bother with a complex thing like a stepper motor, consider this: A stepper motor can be made to turn in exact increments, either very slowly or very quickly. It can be reversed and locked in position. The output torque of a stepper motor can be quite substantial, even at ridiculously low speeds. Power supply requirements are not critical, and given there's an inexpensive IC that does all the work, driving the motor is often no more complex than operating a conventional DC motor.

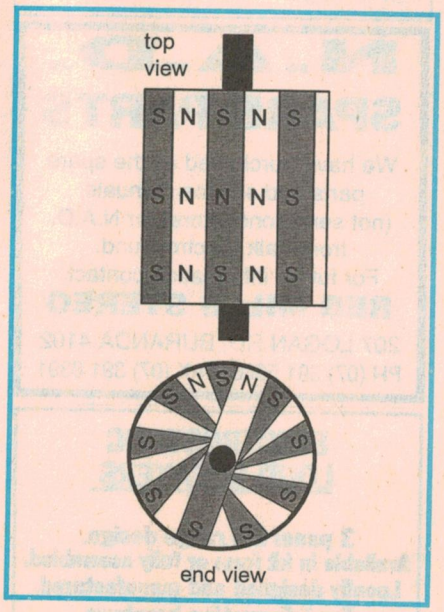


Fig.3: The rotor of a stepper motor is magnetised with alternate north and south poles.

So where are we heading? First up is the stepper motor itself. There are various types, although we will concentrate on the most common type: the six-wire dual coil type. Following this is a look at how to drive a stepper motor. Next month will come the circuit details of two ways of driving a stepper motor, including a description of the 5804 stepper motor driver IC. Also, I'm going to describe how to interface a stepper motor to a remote control system.

First we start by examining how a typical stepper motor works.

The stepper motor

There are many kinds of stepper motors, ranging in size, power, and *resolution*. Resolution refers to the smallest angular amount that the motor can step, and is usually given in degrees. The motor being described here has a resolution of 7.5°, which means it

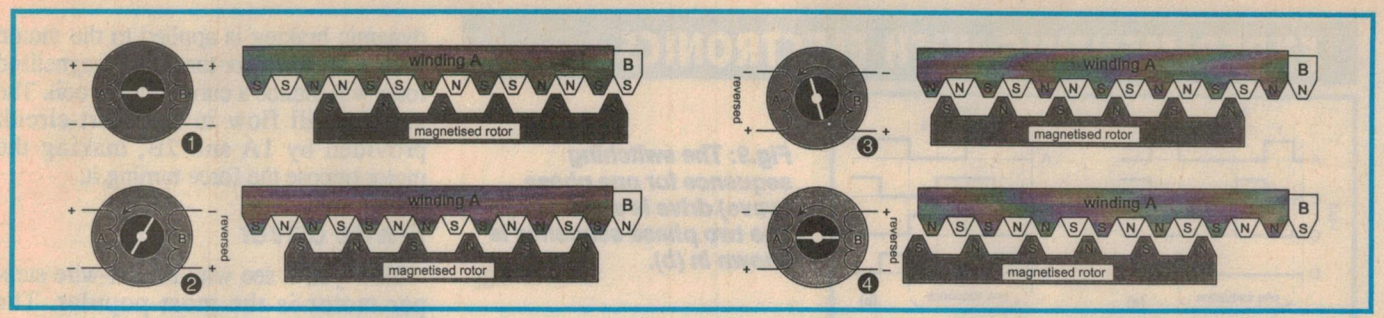


Fig.4: This diagram shows the rotor and stator of a stepper motor 'rolled out' into straight sections. By alternately reversing the polarity of the DC supply to each coil, the rotor 'steps' one tooth at a time.

needs 48 pulses to make it turn 360°, or one revolution.

Three different stepper motors are shown in Fig.1. The top motor is from a large hard disk drive, the small motor at the bottom left is from an IBM compatible 5.25" disk drive. It has a resolution of 1.8°, requiring 200 pulses per revolution. The remaining motor is from a dot-matrix printer.

Stepper motors are therefore easy to obtain, as they are used in most computer disk drives, printers, some electric typewriters, small robots and so on. As well, they are often sold as 'specials' in electronic shops — perhaps as disposal stock.

The motor we are examining (and using) is shown 'exploded' in the photo of Fig.2. This motor was supplied by Oatley Electronics and is a typical example of an inexpensive, 7.5° stepper motor. It is rated at 5V, and the gear fitted on the shaft (it can be taken off if necessary) has a pitch to match gears used in most printers. The hard steel rotor is magnetised with alternate north and south poles, as shown in Fig.3. There are actually 24 magnets in the motor of Fig.2, giving 48 alternate north and south poles around the circumference of the rotor.

The stator is made of three parts. If you examine the photo in Fig.2 you might be able to make out the 12 teeth on each of the three sections.

When assembled, the teeth of the centre section fit between those of the top and bottom parts. The two centre- tapped coils fit around the teeth. When a coil is energised,

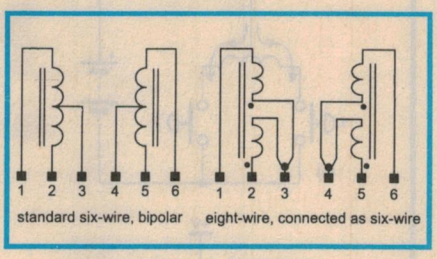


Fig.6: Most stepper motors have six wires, connected as shown here. An eight wire motor can be configured as a six wire type as also shown.

each tooth becomes a magnetic pole with adjacent teeth having the opposite magnetic polarity.

If you have ever pulled a synchronous clock motor apart, you'll be familiar with this arrangement. In fact, a stepper motor is rather like two clock motors back to back. So if you 'unroll' the rotor and the stator, you get something like that shown in Fig.4.

How a stepper works

To simplify the description, the diagrams in Fig.4 assume a four- wire motor. But when you understand one type of stepper motor, you'll find the others are similar.

The sequence to make the rotor turn goes like this: In diagram 1, the two windings are fed from a DC supply with the polarity shown. The magnetised rotor therefore positions itself with its north poles between the south poles of the stator, and its south poles between the north poles of the stator.

If the polarity of the DC supply to winding B is reversed, the poles induced by this coil change polarity to give the condition in diagram 2. The rotor now realigns itself, moving along one tooth.

In diagram 3, the supply polarity to winding A is now reversed, leaving B as it was. The poles induced in the stator by this winding change polarity, and the rotor moves one more step.

Leaving winding A at this polarity, the supply polarity to winding B is now reversed, as in diagram 4. Again there's a polarity change in the poles induced by winding B, and the rotor moves another step.

Reversing the polarity to winding A returns the conditions to diagram 1, and the sequence continues. In other words, to make the motor turn, the polarity to each winding is alternately reversed.

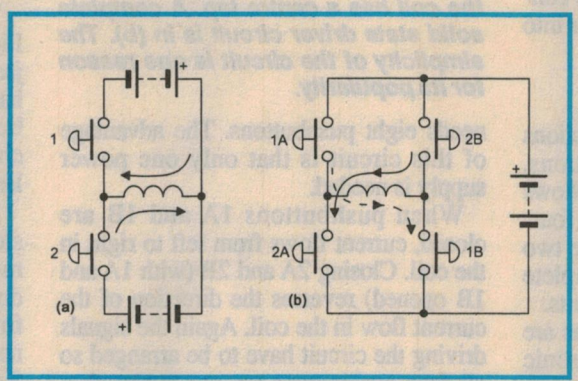


Fig.7: The half-bridge driver is shown in (a) where two power supplies are alternately switched to change the direction of the current in the stator. A full-bridge driver is shown in (b) which achieves the same thing, but with four switches and a single power supply. Note that only one coil per motor is shown, so double these circuits for the complete driver.

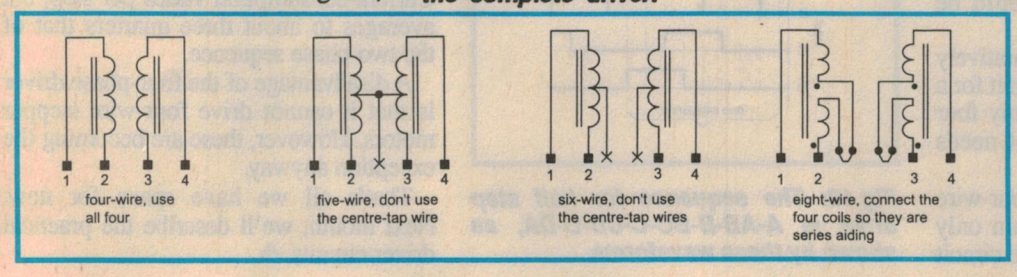


Fig.5: Stepper motors can have up to eight wires. This diagram shows how to connect the different configurations as a four wire motor.

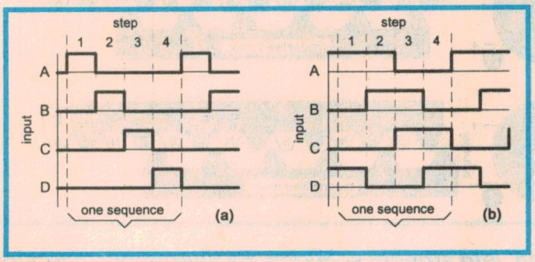


Fig.9: The switching sequence for one phase (wave) drive is shown in (a). The two phase sequence is shown in (b).

The direction of rotation depends on which winding receives a polarity reversal first. The speed of rotation depends on how rapidly the reversal sequence occurs.

Stepper motor connections

A stepper motor driver is an electronic switch driven to achieve the sequence described above. Before looking at driver circuits, we need to examine the internal connections of typical stepper motors. Usually, all you'll know about the motor is that it has a certain number of wires. Where they go will need to be determined with an ohmmeter and trial and error.

The most common stepper motor is the six-wire bipolar type. However, there are also four, five and eight-wire motors. The circuits in Fig.5 show how all of these types can be connected as a four-wire motor. The six-wire type has two centre-tapped coils, as shown in Fig.6. The connections to make an eight-wire motor into a six-wire type are also in Fig.6.

4-wire drivers

Given that the two popular connections are the four and six-wire connections, now for some driver circuits. Fig.7 shows in (a) the half-bridge driver for a four-wire stepper motor. Only one of the two motor coils is shown, so the complete driver would have two of these circuits.

In an actual circuit the pushbuttons are replaced with some type of electronic switch, such as a transistor or a power FET. So in (a), current flows in the motor coil from right to left when pushbutton 1 is pressed. Current flows in the opposite direction when pushbutton 2 is pressed. The signals driving the circuit have to be arranged to make sure that the two pushbuttons are never closed at the same time, as the two power supplies would be shorted out.

The half-bridge driver is comparatively simple, and a complete driver circuit for a four-wire stepper motor needs only four transistors. However the circuit needs two independent power supplies.

The full-bridge driver for a four-wire motor is shown in Fig.7(b). Again only one coil is shown, so the complete circuit needs eight pushbuttons. The advantage of this circuit is that only one power supply is needed.

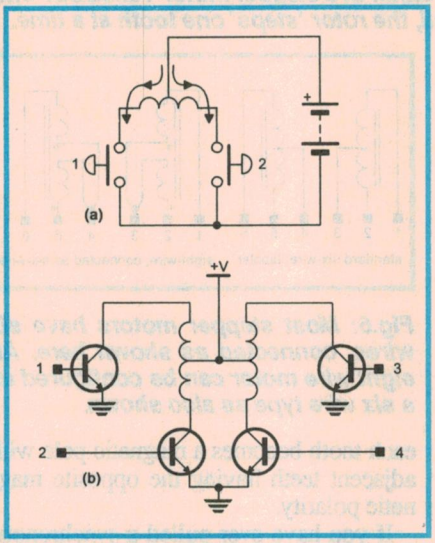


Fig.8: The equivalent switching circuit for one stepper motor coil of a four phase driver is shown in (a). Notice that the coil has a centre tap. A complete solid state driver circuit is in (b). The simplicity of the circuit is one reason for its popularity.

When pushbuttons 1A and 1B are closed, current flows from left to right in the coil. Closing 2A and 2B (with 1A and 1B opened) reverses the direction of the current flow in the coil. Again the signals driving the circuit have to be arranged so all four pushbuttons are never closed at the same time.

Incidentally, if pushbuttons 1A and 2B are closed, with 1B and 2A open, dynamic braking is applied to the motor. That is, if the motor turns, the magnetised rotor will induce a current in the coil. The current will flow in the short-circuit provided by 1A and 2B, making the motor oppose the force turning it.

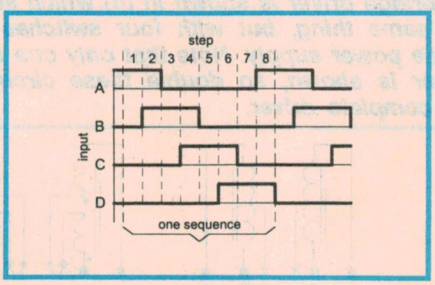


Fig.10: The sequence for half step drive is A-AB-B-BC-C-CD-D-DA, as shown by these waveforms.

6-wire driver

Now you'll see why the six-wire stepper motor is the most popular. The equivalent switching circuit for one coil is shown in Fig.8(a). Notice that only two switches and a single power supply are needed. A complete circuit for both coils therefore needs four switches. However, only half the coil is in use at any one time — so it could be argued that for a given motor size, the power output is halved.

The circuit in Fig.8(b) is the complete driver stage for a six-wire motor. It is generally called a *four-phase driver* and can be operated in one of three ways. The first, called a one-phase or wave sequence, is not used a great deal as only one winding is energised at a time — giving low torque, speed and acceleration.

However, the current consumption is also low and positional accuracy is not affected by a winding imbalance in the motor. The waveforms to pulse a one-phase driver are shown in Fig.9(a). The sequence is A-B-C-D, or D-C-B-A for reverse.

The two-phase sequence is shown in Fig.9(b). This sequence energises two adjacent phases in each detent position and has the sequence AB-BC-CD-DA. It has better torque, speed and acceleration characteristics than wave drive, and is less affected by motor resonance.

But the real advantage of a six-wire stepper is its ability to *half step*. This means the resolution of the motor is doubled, as the rotor now aligns itself, first *between* the stator poles, then at the next pulse, *in line* with the stator poles. So the motor we've been describing can now be operated in 3.75° per step mode, requiring 96 pulses per revolution.

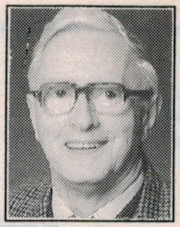
The sequence for half step mode is A-AB-B-BC-C-CD-D-DA, and the waveforms are shown in Fig.10. This mode gives smoother running and even better freedom from motor resonance. Current consumption varies per step, but averages to about three quarters that of the two-phase sequence.

A disadvantage of the four-phase driver is that it cannot drive four-wire stepper motors. However, these are becoming the exception anyway.

That's all we have space for now. Next month, we'll describe the practical driver circuits. ❖

SHORTWAVE LISTENING

with Arthur Cushen,



German broadcasting celebrates 65 years

It was in August 1929 that the first German shortwave transmitter commenced operation at Zeesen near Berlin. The Germans were a little slow in getting into shortwave operation as the BBC Empire Service had been established. But with an 8kW transmitter they began to be received in various parts of the world, and the international feeling of an overseas audience became evident to the German authorities.

Today, that old 8kW transmitter in Zeesen appears to us to have been ridiculously low powered; but it was adequate, as there wasn't much competition in those days. Things changed however, as governments realised the potential of this new instrument. Dictators like Adolf Hitler used it for their own propaganda purposes, but they feared the flood of information from outside that shortwave radio could spread, regardless of national borders.

In the late 1930's, Germany Calling was a familiar sound on shortwave and the transmitters at Zeesen were gradually increased in power. Call signs such as DJB, DJC, DJN and DJD began to be used by the Berlin station and when the Germans occupied Austria, they used their transmitters with call signs such as DJX and DJZ.

World War II found a tremendous increase in the transmitting hours from Berlin, and 'Lord Haw Haw' became a familiar voice. In the last months of the Second World War, between the attempt on Hitler's life in July 1944 and capitulation in May 1945, more than 9000 Germans were executed for having listened to foreign broadcasting stations.

Later, during the Cold War, communist dictatorships also tried to prevent their nationals from listening to shortwave broadcasts from other countries. To this very day they remain a source of uncensored information. Today, though, the airwaves are hopelessly overcrowded. Nevertheless shortwave broadcasting is the simplest method of international mass communication to the remotest parts of the globe.

Deutsche Welle has expanded, not only from its transmitting site at Julich which houses nine 100kW transmitters, but at bases established in Antigua, Kigali, Malta and Sri Lanka.

Time is also leased from many organisations, such as those in Brazil, Canada, Russia, Montserrat and Sines in Portugal.

The transmission to Australia in English is twice daily: 0900 - 0950 on 9665, 15410, 17800 and 21600kHz and from 2100 - 2150UTC on 6185, 9760, 9765 and 11785kHz.

VOA opens in Thailand

The Voice of America is concentrating more of its energy into the Asian area and has already established relay bases in the Philippines and on Sri Lanka. It has now also opened a huge base at Udorn in Thailand. At the cost of US$120M, this consists of seven 500kW transmitters.

One of the major reasons for the establishment of any new shortwave relay is that it is able to reach a distant target at a reasonable cost and without 'gate-keepers' — that is, people who would not like to see a programme heard by the local listeners. Evidence of this was noted recently when China banned all satellite relays of CNN television programmes into hotels in Beijing.

The Voice of America has always had a problem with changing political governments in areas in which they have been established, and one of the most recent was Monrovia in Liberia where a major relay unit was destroyed. According to Bill Whitacre, Chief of VOA's Frequency Management and Monitoring Division, there is certainly a declining audience for shortwave in some parts of the world — especially where listeners are able to receive programmes by satellite — but this is a long way off in Asia.

Though there are seven transmitters at Udorn, only six will be used by the Voice of America. As part of the agreement the seventh transmitter is to be used by Radio Thailand, which is to introduce an international service in the coming months. ❖

AROUND THE WORLD

AUSTRALIA: Radio Australia has added two new transmitters at its Darwin transmitting site and this will mean an expansion in coverage, particularly into Asia. The additional two transmitters will enable more frequencies to be used to North Asia in English and Chinese. This addition means that there are now five transmitters at Darwin and they operate 16 hours a day; Radio Australia is looking at the maximum use of Darwin, as it is their closest link to Asia. The completion of the Darwin installation is the culmination of a project which cost A$12M — which also covered the installation at Shepparton of five new aerial arrays.

Radio Australia at present is carrying the BBC World Service 2200 - 2300UTC on 11695kHz, but according to the General Manager of Radio Australia, Mr Derek White, there are no plans to extend leasing time to other international broadcasters.

GUAM: KTWR, which has a mailing address of 1868 Halsey Drive, Asan, Guam 96922-1505 now broadcasts in English at 0800 on 15200kHz; at 0900 on 11840kHz and at 1500UTC on 11580kHz. The latter two frequencies are new to KTWR.

HONDURAS: In a verification letter from Radio International, (Apartado Postal 1473, San Pedro Sula) the General Proprietor indicates that they operate with 1000W on 4930kHz. The station was heard opening at 1100 and closing at 0500UTC. Verification included a card showing the call HRQO, a sticker and a bank note. HRQO commenced operation on 15 April 1994.

Radio Copan International transmits daily from 1900 - 2000UTC on 15675kHz. The programme is a mixture of English and Spanish and includes a number of feature programmes. The mailing address for reports is the same as WRMI, 8500 SW 8 Street, Suite 252, Miami, Florida 33144, USA.

ITALY: Rome Radio advises that they plan to recommence their service to Australia which was discontinued in 1990. Frequencies and times of this new transmission are yet to be announced. In the meantime English can be heard at 2200UTC in a service to Japan on 9710, 11800 and 15330kHz.

MONGOLIA: Ulan Bator has a half hour programme in English to Australia at 0910 - 0940 on 11850 and 12050kHz, and the same frequencies are used for a transmission 1200 - 1230UTC; others are to Asia at 1445 - 1515 on 7250, 13780kHz, and to Europe at 1940 - 2010 on 11790kHz, 11850kHz.

NEW ZEALAND: The Radio Reading Service, Levin has introduced an additional frequency of 5960kHz (USB) and along with 7290kHz operates Sunday - Friday (sign on 2030) through to Monday - Saturday (sign off 0500). The broadcast is also carried on 1602kHz and 3935kHz, which continue to broadcast up to 1000UTC and these two frequencies also are in use on a Sunday 0600 - 0900. However, when NZ is on daylight time, broadcasts will be heard one hour earlier.

ST HELENA: Another special broadcast from St Helena is scheduled this year for Friday October 14 from 2000 - 2300UTC on 11902kHz. This is becoming a regular feature each year and gives listeners a chance to hear this remote island in the South Atlantic.

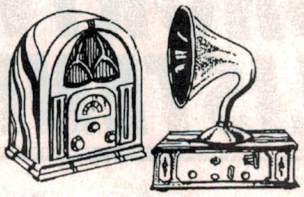
TONGA: Nuku'alofa A3Z on 1017kHz has been heard around 0700 and according to an RNZI official who visited the station the 500W transmitter, 5030kHz is still in the transmitter building. But the dipole antenna was blown down in the cyclone many months ago and has not been replaced. Possibilities of its return to air are still a long way off.

WESTERN SAMOA: Apia has a new FM station on 106.1MHz which carries gospel programming and is operated by the Meredith Family. The address of the station is PO Box 3444, Apia. The Government station 2AP is heard on mediumwave 747kHz and at 1000UTC has been noted carrying the news from Radio New Zealand International.

This item is contributed by Arthur Cushen, 212 Earn Street, Invercargill New Zealand who would be pleased to supply additional information on medium and shortwave listening. All times are quoted in UTC (GMT) which is 10 hours behind Australian Eastern Standard Time and 12 hours behind NZ Standard Time.

Vintage Radio

by PETER LANKSHEAR



The unusual Wunderlich valve

For much of the first 70 years, the technology of the radio industry was centred on valves, which were made by the million in many hundreds of different types. It is not surprising therefore, that for a large number of vintage radio enthusiasts a valve display is a significant part of their hobby. This month, we discuss a rare and attractive specimen.

Even valves like that old mainstream stalwart, the type 6V6 output tetrode are collectable. In my own display, I have at least six examples of the 6V6, all with distinctly different shapes, sizes and methods of construction, and originating from five different countries.

Much of the diversity in valve types was really unnecessary. In many cases, a new valve was no more than an existing type, repackaged with a new envelope or a different base. However, given their wide use over such a long period of time, it was inevitable that some innovative valve designs would emerge. Some of these new concepts established fresh directions for technology, but others failed to gain wide acceptance and disappeared. This month we will look at one of the latter — a type that showed considerable promise, but which was overtaken by more adaptable types.

With a bright blue glass envelope and reddish brown base, the 'Wunderlich' shown in Fig.1 was one of the most colourful valves ever made. With a unique dual co-planar control grid, it was a 1932 product of America's Arcturus Company. Aptly named the Wunderlich — German for unusual or odd — it actually took the name of its inventor, Norman Wunderlich, who is reported to have worked originally for the RCA Victor Company and later as the Arcturus sales manager.

One way of describing the Wunderlich valve is that it was a triode with two identical interleaved control grids, between a single anode and common cathode. Unlike a conventional multigrid valve, the grids were not concentric, but were of equal diameter in the one plane. As can be seen in Fig.4, there were two identical grid assemblies, each with an independent closely spaced pair of support rods, and each grid having equal

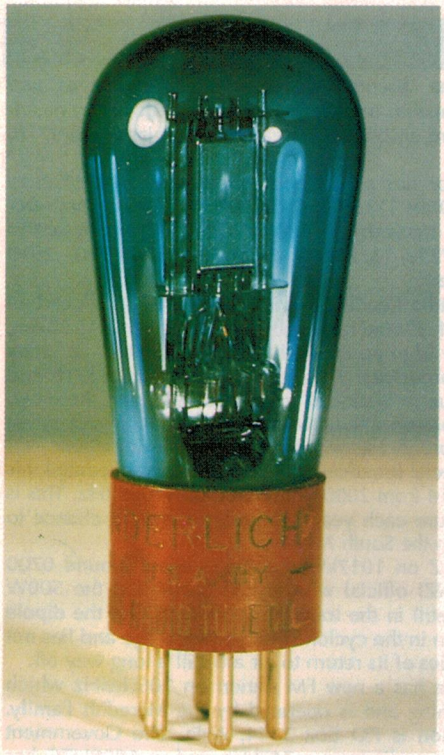


Fig.1: With its red bakelite base and blue glass, the Wunderlich valve stands out in any display. The blue glass was an Arcturus trademark.

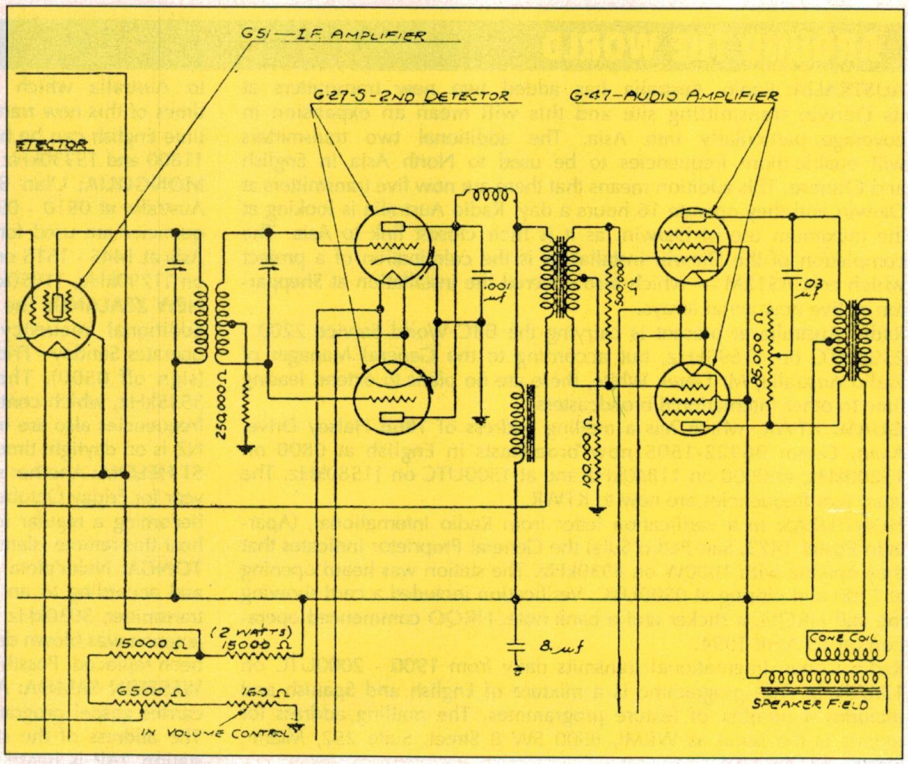


Fig.2: The traditional grid leak detector had shortcomings that created audio distortion. One solution was push-pull operation using valves like the 27, as used in the Grigsby-Grunow model 25 Majestic receivers. But this required an extra valve, at a time when they were very expensive.

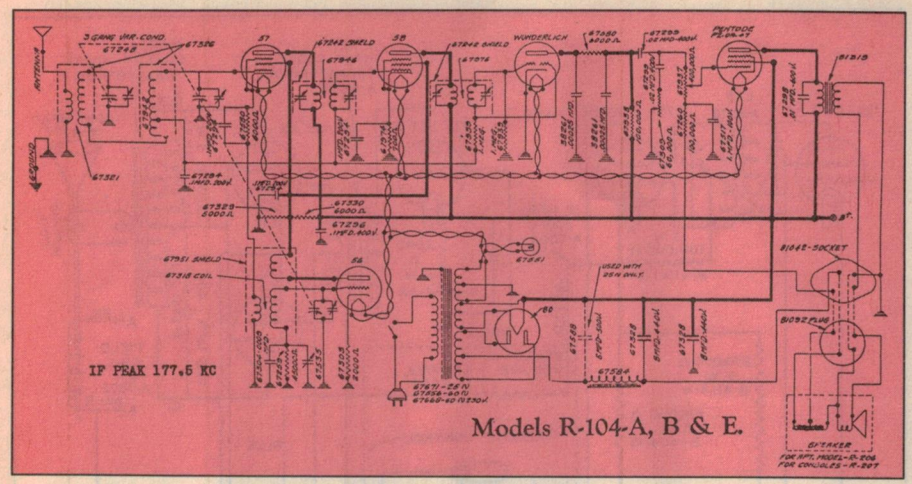


Fig.3 (above): A major user of Wunderlich valves, Stewart-Warner featured the detector in at least seven of their 1932/33 models. Their application is similar to that in other makes of Wunderlich-equipped receivers.

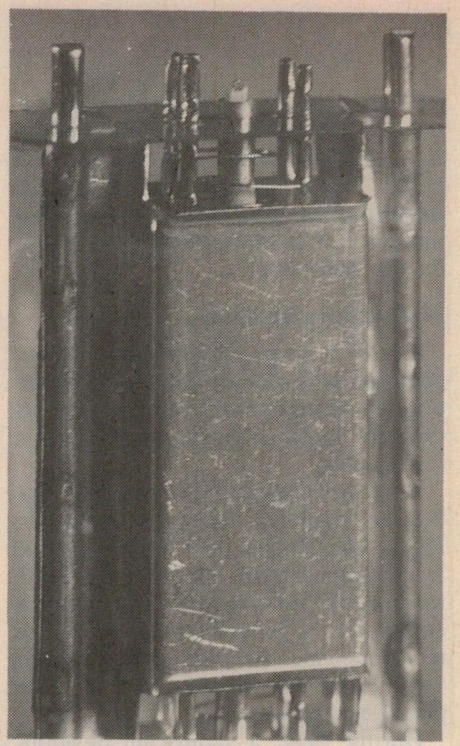


Fig.4 (right): This closeup of a Wunderlich internal assembly shows the top segment of each of the two grids, just above the rectangular plate. In conventional valves, the grid was wound in a spiral around the two support rods. But in this design each turn is an individual loop, and the loops of each grid are interleaved together around the cathode.

control. The grid elements, rather than having the orthodox spiral construction, were made in the form of rings.

In the years around 1930 there were frequent developments in radio technology. One field of research was the search for improved detectors. The widely used grid leak detector had its origins in the earliest days of radio, but in the standard form, it produced serious distortion — especially with strong signals at high modulation levels. A popular improvement was the system called alternatively 'anode bend', 'plate' or 'biased' detection, in which the detector valve was biased nearly to cutoff. However distortion was still somewhat high and it did not provide AGC voltages.

Improved detection

Despite its early origins and apparent simplicity, the operation of the grid leak detector is quite complex, with the grid performing two functions of a diode and directly coupled control grid. The diode action causes the grid to take up a negative bias that is proportional to the signal strength, and consequently there is only a small range of signals which will permit optimum operation.

One outcome is that, before the audio signal reaches an adequate level to drive an output stage, there is serious distortion. Furthermore, for good efficiency, a relatively large value of grid capacitor is necessary, seriously attenuating high audio frequencies.

One solution was to use a push-pull detector, a good example being in the 1931 Majestic model 25, the relevant part of the circuit being shown in Fig.2. The operation of a push-pull detector is analogous to a class B amplifier, where the asymmetrical outputs of the two halves are combined to cancel distortion. As a grid capacitor is not necessary, another benefit is improved high frequency audio response.

Although the push-pull grid leak detector was a big improvement, it was not very much used — probably because it required an extra valve. Today, this may seem to be of no great consequence; but in 1931, a valve cost an appreciable percentage of a week's wages.

Two valves in one

Wunderlich seems to have conceived his valve as the equivalent of a balanced grid leak detector, with the economy of a single envelope. A Wunderlich detector was operated in a balanced mode. The grids were driven equally, but in opposite phase so that as one grid went negative the other was driven positive. The effects of the two balance out, with any RF cancelling and leaving only amplified audio.

In practice, a Wunderlich detector can develop three times as much audio signal as a simple grid leak detector. There was a bonus in that, just as with the conventional diode detector, a negative voltage generated by the diode action was available for automatic gain control.

Although the original purpose was that of a push-pull grid leak detector, and this appears to have been its only application in receiver production, according to F.E. Terman the Wunderlich valve was used for a variety of laboratory applications.

One characteristic of the Wunderlich valve that does not seem to have been developed commercially was its ability to operate in a *space charge mode* if one of the grids was positively biased. Electrons were attracted from the cathode in copious quantities by a positively biased grid, but the majority overshot and went on to the anode, and the result was a much larger cathode current than could be obtained conventionally.

Several variations

The first Wunderlich had a 2.5 volt heater, a five-pin base and a top cap cathode connection. However, a contemporary development was the six-pin base being fitted to the new RF pentodes. This new base provided a single ended alternative for otherwise identical Wunderlich valves, which were unique in that they were not initially given a classification number or letter, but simply labelled 'WUNDERLICH - MADE IN USA BY - ARCTURUS RADIO TUBE CO'.

The practice of providing alternative bases on valves with the same type number was common in Europe, but the Wunderlich is a rare American example. When subsequently a 6.3 volt heater six-pin version was produced for car radios, an identification became necessary. The original 2.5 volt triodes were then referred to as type A and the 6.3 volt version became type A Auto.

A fourth Wunderlich valve appears on some lists. The type B is shown as having

a screen grid as well as the double control grid, but there is little published information other than that it had a 2.5 volt heater. This valve could have had some interesting characteristics, but I can find no record of its having been used in production receivers.

Not many users...

The Wunderlich valve was a good concept, but was used in less than a dozen different brands of receiver over a period of about a year, and even then only in a few models.

A typical application is shown in the Stewart Warner R104 circuit shown in Fig.3. One notable user was expatriate New Zealander E.H. Scott, in his 1933 receiver. Arcturus valves were standard equipment in Scott's legendary deluxe receivers, and the blue valves looked very handsome against the chrome plated metalwork.

During 1932, a significant development in detector applications was the introduction of the type 55, 85 and later the 75 double diode triodes. Virtually three valves in one envelope, they could be used simultaneously for amplifying, detection and AGC, but with the advantages that the complications of a push-pull input were not essential and the diode detector could not be overloaded.

These advantages were too great for the Wunderlich to counter, and inevitably the more versatile diode triodes were the ultimate survivors.

Wunderlich substitutes

Although many valve manufacturers, including RCA, chose to ignore the Wunderlich valve, Sylvania and Ken-Rad did not. Sales of replacement valves were important and Sylvania had a policy of stocking 'a tube for every socket' — but naturally it would have resisted having to make any payment of royalties to Arcturus so could not have made direct copies.

Their solution appears to have been a series of double triodes that would be plug-in equivalents for the Wunderlich detectors. Only the anodes of these valves were common to both halves; the cathodes and grids were independent. They were, in reality, double triodes with their anodes and cathodes tied together.

There were five of these double triodes, and, having six-pin bases, they were replacements for the type A Wunderlichs. Three were from Sylvania, whose type 29 had a 2.5 volt heater and would have been equivalent to the Wunderlich A of Fig.1. Types 69 and 70 were similar but had different sized envelopes, and with 6.3 volt filaments would have been for car radios. Ken-Rad made the other two double triode Wunderlich alternatives. The type 90 had a 2.5 volt heater and the 92 a 6.3 volt.

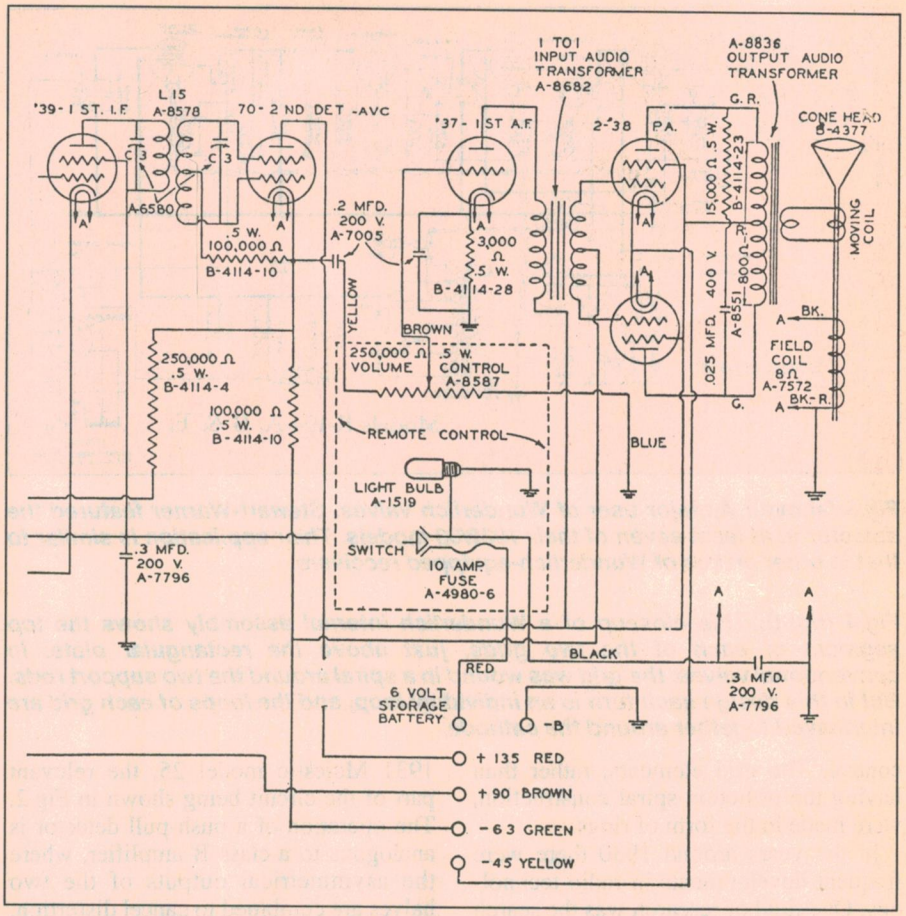


Fig.5: A sophisticated application of the dual-grid detector was in the Sparton model 34 car receiver, incorporating the Sylvania/Sparton type 70 — the only recorded instance of a dual detector triode other than the Wunderlich being used in commercial production. Here the 70 valve acts not only as a push-pull detector but also as an early example of a cathode follower, feeding the audio to the volume control and the negative AGC voltage to the IF and RF stages.

Sylvania's type 70 valve was sold as well under the Sparton label, and seems to have been the only Wunderlich equivalent ever to have been used in a production receiver. This was the detector and AGC amplifier in the Sparton model 34 car radio, the relevant part of the circuit being shown in Fig.5.

There is some irony in the fact that the Wunderlich valve would have been ideal for this unconventional application, with the functions of a balanced diode detector and DC amplifier for the AGC line. This was the type of application that the Wunderlich valve would have been very suited to, and it is unfortunate that it did not have more time to have been incorporated into specialist functions.

Had it been available a year earlier, it is possible that the Wunderlich would have become more widely accepted and further applications developed. Who knows — instead of the pentagrid, the screen grid Wunderlich may have become the first frequency converter valve. As it was, the Wunderlich quickly faded into oblivion and the diode-triode remained by far the most popular detector option for the following 30 years.

How good was it?

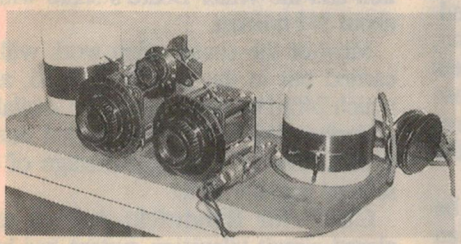
How well does a double grid leak detector perform? For an evaluation, I wired into a suitable receiver a general purpose double triode as a detector similar to that of the Stewart-Warner 140. It worked quite well, certainly much better than a conventional grid leak detector.

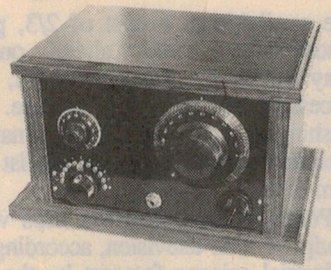
One type of transmission did upset it, though. This was a strong signal with heavy audio 'processing', an obnoxious practice indulged in by some AM radio stations to improve their coverage with positive overmodulation. Overall, the push-pull grid leak detector had no ad-

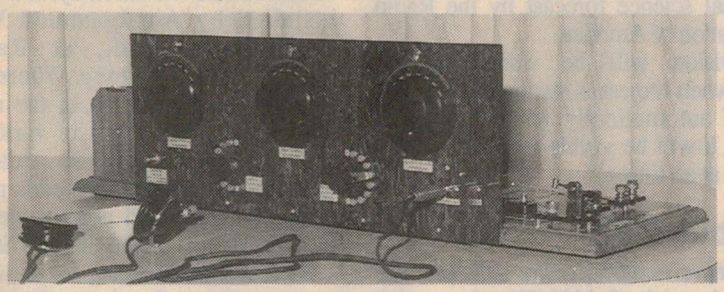
Crystal sets galore

History was recreated recently by enthusiastic members of the Vintage Radio Club of North East Victoria — many of whom were reliving their youthful experiments in radio. Fifteen crystal sets newly constructed by members were judged for the annual club achievement award.

The Hellier Award was established by the club to honour Les Hellier, the founder of 3WR, the first Australian country radio station. 3WR commenced transmission on 25 February 1925 in Wangaratta, NE Victoria, but moved to Shepparton in 1934, to later become 3SR Shepparton.







Top left is Harvey Utber's two-tuned-circuit model, which was a section winner. Top right is John Hill's set, which won a runner-up award for its high standard of construction and cabinet. Above is Bob Young's exhibit, described as the 'Harley Davidson' of crystal sets, which won the Vintage section.

Some of the crystal sets built were absolute labours of love, and would have been great talking points in the lounge rooms of the 1920's. A variety of designs were presented, from the very basic to those using multiple tuning circuits. There were also examples of first class cabinet work, to complement the construction.

Past President Bob Young has also recently prepared a book on crystal receivers.

The club meets monthly. Details are available from Ralph Robertson VK3CQK, on (058) 52 1372, or Bill Savage (057) 28 1485.

vantages over the more versatile conventional diode triode detector.

And finally...

We started off with comments about valve collecting. Recently, there were trade announcements indicating that transistors were in short supply, and reading between the lines it seems that in the future they will remain that way. Increasingly, transistors are being displaced by integrated circuits, just as 30 years ago, valves were steadily replaced by transistors.

Although a display of valves is more visually interesting, shouldn't we now be collecting transistors? History is repeating itself, and what is today still relatively commonplace will soon have disappeared. How long is it since you have handled a 2N217, or an OC75, or a 2N301? For that matter, when did you last buy a BC107? ❖

50 and 25 years ago...

'Electronics Australia' is one of the longest running technical publications in the world. We started as 'Wireless Weekly' in August 1922 and became 'Radio and Hobbies in Australia' in April 1939. The title was changed to 'Radio, Television and Hobbies' in February 1955 and finally, to 'Electronics Australia' in April 1965. Below we feature some items from past issues.

October, 1944

Technical data from A.W. Valve Co: A recent circular to hand from the Amalgamated Wireless Valve Company indicates that they are giving fresh attention to the publication of technical literature — an activity that has been drastically curtailed by the burden of war work.

Servicemen and enthusiasts generally will welcome the statement that "We hope to make an announcement shortly in connection with the publication or Radiotronics."

Of more immediate interest is the fact that the Company has adequate stocks on hand of the 'Radiotron Loose Leaf Valve Data Booklet', which contains full technical information and operation curves for all Australian made valves, plus certain other imported types. Copies of the Valve Data Booklet, in cardboard binder, are available at a cost of 2/3, posted. Those with a booklet already on hand, may obtain for the sum of 6d, sheets necessary to bring it up to date. Those wishing to receive new sheets, may have their name added to the mailing list for the sum of 2/-.

Postwar cars: Postwar cars will be equipped with television, according to an industrial science forecast by the Radio Corporation of America.

Television will be visible to the driver when the car is stationary, and will cut off automatically when the car is started. It will be visible to backseat passengers at all times.

October, 1969

Hydro-electric power scheme for NSW: A total of 400MW of pumped storage hydro-electric power will be incorporated in the Kangaroo River-Fitzroy Falls section of the Shoalhaven (NSW) Water Supply Scheme. The scheme is located about 15 miles to the north west of Nowra on the South Coast of NSW.

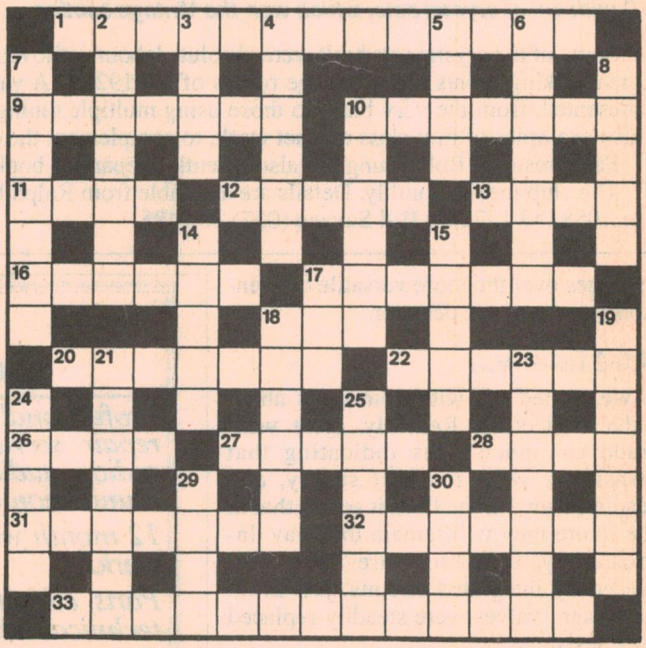
The scheme is being undertaken jointly by the NSW Electricity Commission and the Metropolitan Water Sewerage and Drainage Board. Expenditure by the Electricity Commission on the joint scheme is expected to be about $15 million and the Water Board's share will be about $41 million.

Most of the construction work will be carried out in the period 1971-76, after which 240MW of power will be available. A further 160MW will be added during construction of the second stage of the scheme in about 1990.

CCTV for Randwick: A large scale closed circuit television system has been installed by Amalgamated Wireless (Australasia) Ltd., at Randwick racecourse in Sydney. There are 50 monitors on four floors of the new $4.6 million grandstand and in various locations in the racecourse area. These monitors show totalisator odds prior to a race, dividends and correct weights, as well as placings on the 'in field' indicator.

Facilities are included for showing, between races, 'off air' television pictures such as major sporting events. ❖

EA CROSSWORD



ACROSS

1. Type of diode. (5-8)
9. Such is the design of certain loops. (7)
10. Style of music. (7)
11. Restrictive effective, the —— e.m.f. (4)
12. Put security system into ready mode. (5)
13. Small SI prefix. (4)
16. Modernise. (6)
17. Trips taken by Space Shuttle, etc. (7)
18. Recovery area for Apollo spacecraft. (3)
20. What the bridge did to the voltage. (7)
22. Circuit breaker. (6)
26. Acronym associated with analog cellular mobile phone system. (4)
27. Regions of magnetic significance. (5)
28. Symbol representing nature of charge. (4)
31. Said of simple AM-FM radio receiver. (3-4)
32. Vary in light intensity. (7)
33. Emissions of radioactive decay. (4,9)

DOWN

2. Generated. (7)
3. Colours. (4)
4. Make more certain, as does a fail-safe system. (6)
5. Prefix meaning a million millions. (4)
6. Name given to a thermal noise theorem. (7)
7. Rare earth element discovered by Mosander. (7)
8. Gas used in high intensity discharge lamps. (5)
10. Resistance reduction at high frequencies is the —— effect. (6)
14. Elongated appliance, the —— heater. (5)
15. Steam generating heavy water reactor. (1,1,1,1,1)
17. Provided supply. (3)
18. Basic SI unit. (6)
19. Diverted some current in parallel. (7)
21. Collapse. (7)
23. Small current. (7)
24. Antenna supports. (5)
25. Performing group of six. (6)
29. Information collected by a logger. (4)
30. Metallic element that melts at 418°C. (4)

SOLUTION FOR SEPTEMBER 1994

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D	E	N	S	E		B	A	N	D	W	I	D	T	H

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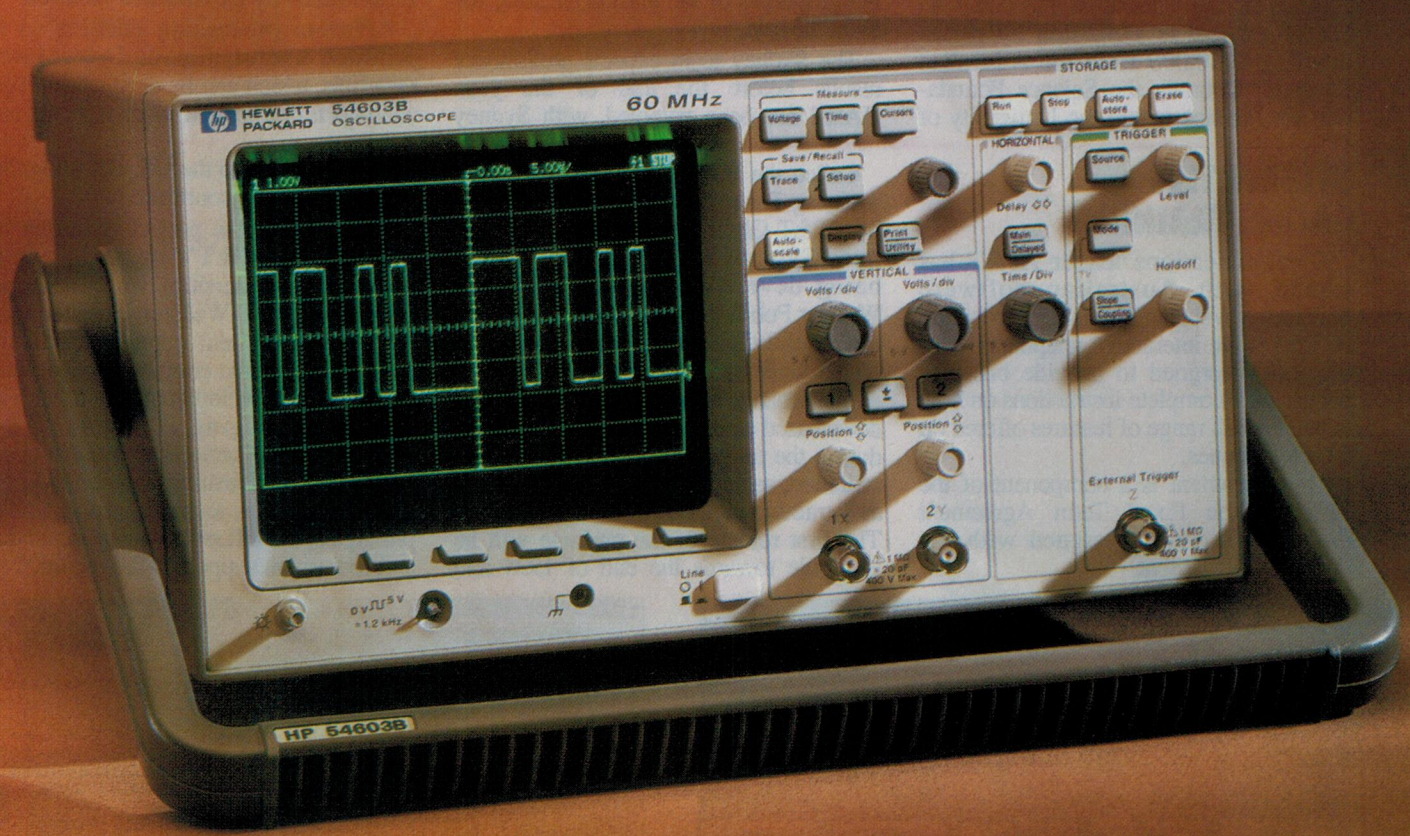
S • U • P • P • L • E • M • E • N • T

AUSTRALIAN SWITCHES FOR JINDALEE RADAR

SYDNEY UNI, ANU MAKE NOVEL PLASMA COATING SYSTEM FOR CBN FILMS

REVIEWS OF NEW PC SOUND CARD, SWITCHING AC POWER CONVERTER



HEWLETT-PACKARD'S NEW 54603B 60MHZ ECONOMY DSO: TWO CHANNELS, 1.5M POINTS/SEC DISPLAY UPDATING, AUTOSCALING & 'ANALOG RESPONSE' — FOR ONLY $3100

NEWS HIGHLIGHTS

AUSTRALIAN DEVELOPED PLASMA COATING UNIT

A unique device that is the first of its kind in the world — designed collaboratively by physicists at Sydney University and the Australian National University (ANU) and constructed at ANU — will significantly advance the production of new plasmas for protective coatings with a range of industrial and product applications.

The Helicon Assisted Reactive Evaporation (HARE) device is the culmination not only of collaboration between Sydney Uni and ANU, but also of cooperation between Sydney's Department of Applied Physics and Plasma Physics in the School of Physics. The HARE project is supported by grants totalling $750,000 from the Australian Research Council, the Science Foundation for Physics within the University of Sydney, the Faculty of Science and the School of Physics.

Two and a half years ago, collaboration commenced on the plasma processing project with ANU, which had already developed the Helicon technique for etching silicon chips. "Our apparatus is meant primarily as a deposition, not an etching apparatus," said Dr McKenzie.

HARE, according to Dr Falconer, has already spawned several additional projects. CSIRO recently developed an ellipsometer, a small instrument that focuses on the polarisation of light reflected off film. "This will enable us to measure properties of the film as it grows — without taking it out of the chamber — and at the same time we can measure the properties of the plasma, relating the two," he said.

The Sydney team expects preliminary results before the end of the year. HARE has been patented, with Sydney and ANU as equal partners, and a company has already expressed interest in marketing the apparatus as a deposition system. At present there are only two HARE devices in the world, one at Sydney that is used exclusively for plasma deposition, and one at ANU, which is used primarily for etching.

The Sydney HARE research team comprises its three instigators at Sydney, Senior Lecturers in Physics, Dr Brian James and Dr Ian Falconer, and Reader in Physics, Dr David McKenzie; Physics Lecturer, Dr Joe Kachan; Boron Nitride Program Research Assistant, Mr David McFall; Senior Technical Officer, Mr John Piggott; and PhD and Honours students. They will collaborate with an ANU team headed by Dr Roderick Boswell.

"Plasma processing enables us to produce useful diamond-structured materials, which can be used as thin film coatings for protective, wear-resistant and

INTERACTIVE PHONE TRAINING

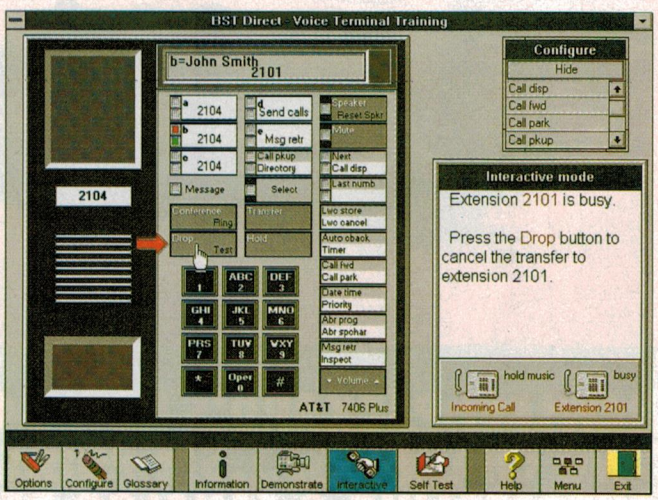
Communications leader AT&T has joined with Australian software developer Webster Publishing to create an innovative interactive telephone training tool, designed to provide business people with complete instructions on how to use the full range of features offered on their telephones.

The agreement is a component of the $104 million Fixed Term Agreement that AT&T recently signed with the Federal Government.

Called the BST Direct Voice Terminal Training Package, it has been designed by AT&T Global Business Communications Systems (AT&T GBCS), and is being developed by Sydney based Webster Publishing to provide training on analog and digital telephones attached to AT&T Definity PABX systems.

The package operates on PCs in a Windows based environment and will be used during the training phase of a PABX installation, as an ongoing training tool and as a training method for new employees. The first release of the package will be available towards the end of 1994 and will be exported to the US, UK and other English speaking countires.

"This innovative project is further indication of AT&T's commitment to developing partnerships with Australian companies, and Webster Publishing is providing excellent capabilities in the area of multimedia computer based training software development," said Mr Tim Wilson, Managing Director, AT&T GBCS. "At the same time, we are offering Webster Publishing access to AT&T Bell Laboratories technology and quality principles, as well as providing marketing and promotion support in the region."



electronic applications," said Dr McKenzie. "We will measure the plasma produced by HARE in order to quantify plasma processing. We're keen to produce high quality cubic boron nitride (CBN) coatings economically and in viable quantities."

"To do so, we evaporate boron from its solid phase, adding nitrogen gas mixed with argon. CBN, a synthetic abrasive with the same structure as a diamond, can be used for industrial tools such as cutting and polishing wheels, and for these purposes is superior to diamond, which can burn and produce carbon dioxide."

CBN coatings can be used not only as abrasives but also to protect sunglasses, windows of sensors, camera lenses, infrared detectors and windows of aircraft, which abrade when particles of water collide with the window.

EXPERTS' BROADBAND REPORT RELEASED

The interim report of the Broadband Services Expert Group, titled 'Networking Australia's Future', has been released.

The Expert Group, headed by Mr Brian Johns, Chairman of the Australian Broadcasting Authority, is examining the technical, economic and commercial preconditions for the widespread delivery of broadband services to homes, businesses and schools in Australia.

"The Expert Group believes the most exciting aspect of the convergence of computing, broadcasting and telecommunications is the opportunity to create 'content' — the information carried by broadband networks," Mr Johns said. "This content stands to change our private lives, our education, how we do business and the delivery of government services. It will also generate considerable wealth."

The report was launched by the Minister for Communications and the Arts, the Hon. Michael Lee, at an Arts Law Centre of Australia/Gilbert and Tobin conference on Multimedia and the Law at Sydney's Powerhouse Museum.

"There are considerable opportunities for Australian industry in developing leading edge applications and content for broadband networks," Mr Johns said. "There is also scope for companies to be involved in the building and running of these networks."

"However, the Expert Group believes the content of communications services is a fundamentally more important issue than the means of delivering them," he added. "The creative infrastructure required for these services will be the source of commercial opportunities for Australia, which has the talents to stake a claim on world markets for new multimedia content. There have already been some striking successes in this area."

The Expert Group believes the government sector has the potential and the obligation to play a leadership role in developing broadband services. Government services, especially those with a mass customer base such as social welfare, could be delivered more efficiently with the help of the new communications services. Access by citizens to the vast amounts of information held by governments also has great social and economic benefits.

The Expert Group has identified the delivery and health and education services on broadband networks as a significant social issue for future study.

SYSTEM MANAGES VICTORIA'S POWER

One of the most sophisticated and advanced energy management systems available in the world is now operating Victoria's extensive electricity power supply system.

The new Energy Management System (EMS) which features the very latest in computer hardware and advanced applications software, is a multi-million dollar project, and places Victoria at the leading edge of world power system operating technology.

The system provides Victoria's system control engineers with improved and more timely information that enables more efficient, reliable and economical operation of the power supply network. In addition, it allows more accurate scheduling of power generation to achieve minimum system operating cost.

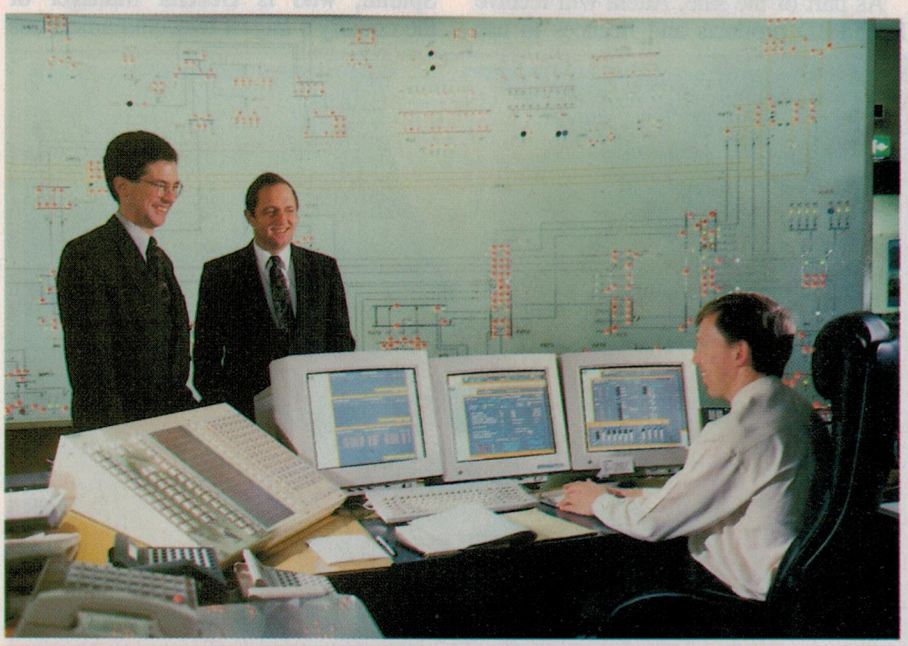
The new system, ordered from Siemens in 1990 by the then State Electricity Commission of Victoria (SECV), has only become operational after completing a phased installation program coupled with extensive testing. The phased installation program allowed the new EMS to be used for the past 18 months to assist in minimising power system losses, already resulting in annual savings of hundreds of thousands of dollars for Victoria.

The EMS is located at the Richmond System Control Centre, currently owned and operated by National Electricity (formerly part of the SECV).

Later this year, ownership of System Control Centre and the new EMS will pass to the Victorian Power Exchange (VPX), one of the new entities to be formed as part of the Victorian Government's far reaching reform of the Victorian electricity supply industry.

These reforms will also see the establishment of the Victorian Wholesale Electricity Market (WEM), and the new EMS will assist VPX to meet the challenging operational demands of this new market structure.

Further, the new EMS will enable Victoria to take a leading role in the operation of the future National Grid, planned to be phased into operation from July next year. The National Grid will initially consist of the electricity supply networks of Victoria, NSW and South Australia, with plans for extensions to include Queensland and Tasmania in the years ahead.



NEWS HIGHLIGHTS

ALTERA ACQUIRING INTEL PLD BUSINESS

Altera Corporation is acquiring Intel Corporation's programmable logic business for a price of approximately $50 million. The transaction was expected to be completed on October 1, 1994, subject to governmental approval. Immediately after the closing, Robert Reed, Senior Vice President and General Manager of Intel's Semiconductor Products Group is expected to join Altera's board of directors.

The relationship between the two companies dates back to 1984, when Altera licensed Intel to make Altera's first family of products in exchange for process technology and wafer manufacturing services. "Intel is the premier semiconductor company in the world. Our partnership with Intel played a significant role in Altera's early development and we look forward to continuing our relationship with Bob Reed on our board of directors," said Rodney Smith, president, CEO and chairman of Altera Corporation.

As part of the sale, Altera will receive Intel PLD products and licences to use associated process technologies and intellectual property to build PLD products. In addition, Intel agrees to supply wafers to Altera in support of the business.

"Altera is a recognised leader in the programmable logic market. Intel's investment in Altera allows Intel to share in the continued growth and development of the PLD market and to realise the best possible return on its prior investment in this business. I will work actively with Altera to ensure a smooth transition for Intel customers," said Bob Reed of Intel.

Employee transfers are not included in the transaction. However, Altera, at its discretion, may make employment offers to any of Intel's current PLD employees.

NEW TELECOMMS BODY

"A powerful new industry body has been established to represent the telecommunications equipment industry in this country — the Australian Telecommunications Industry Association (ATIA)," announced its newly elected president, Ron Spithill, in Sydney.

ATIA will have as its prime objectives "the promotion of an internationally competitive Australian telecommunications equipment industry," said Mr Spithill, who is General Manager of the country's largest telecommunications manufacturer, Alcatel Australia. "ATIA will represent this dynamic industry to key policy makers and highlight the important contributions it can make to Australia's economic development and future."

"This is essential as the Australian telecommunications industry heads towards another major watershed — the commencement of the post 1997 telecommunications review," Mr Spithill explained.

"I will represent ATIA on the Telecommunications Advisory Panel reporting to the Minister for communications, Michael Lee, on post 1997 issues. I look forward to the opportunity to contribute, particularly on future industry policy arrangements."

The Australian telecommunications equipment industry is a micro-economic reform success story, with sales in 1993 exceeding $3.5 billion (an increase of over 10% on 1992). Exports are growing at 40% per annum — $500 million in 1993, compared with only $80 million in 1990. The industry is on track for exports to reach $1 billion by 1996, primarily to the Asia Pacific region.

Membership of ATIA exceeds 100 companies and includes all the major Australia based manufacturers of telecommunications equipment and systems. ATIA will operate within the umbrella of AEEMA (The Australian Electrical and Electronic Manufacturers' Association).

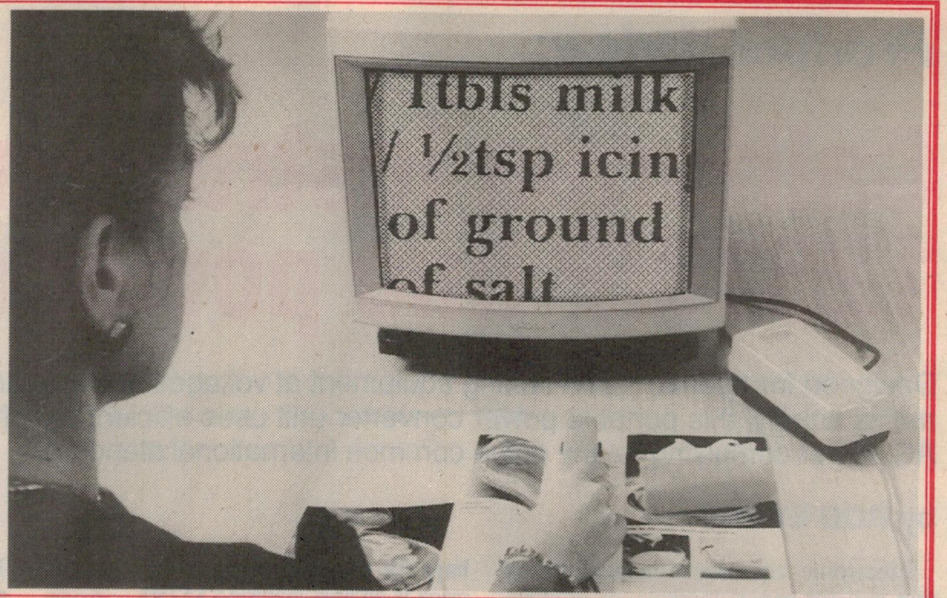
ABB Nera in Norway has developed this Saturn Bt Digital Satellite Terminal for the Inmarsat B system, designed to provide regions with little or no infrastructure with new opportunities for international telephone, fax and data communications at low cost. Inmarsat B operates at 1.5/1.6GHz.

FUJITSU WINS PRODUCTIVITY AWARD

Fujitsu Australia Limited has been awarded a Southern Cross Productivity Award for Excellence, for its contribution to Australia's productivity performance. Announced at a ceremony in Brisbane, the award is recognition of the efforts of Fujitsu, in alliance with Stallion Technologies and Datacraft, towards exporting locally manufactured product.

The Southern Cross Awards recognise Australian companies who have achieved outstanding success within the Federal Government's Partnership for Development Program. This program, which commenced in 1987, comprises companies and organisations which are working together to develop new products and services in Australia and win new export markets.

Against fierce competition, Fujitsu's world class manufacturing facility in Dandenong, Victoria, secured large scale orders in October 1992, to manufacture PC Communication Routers. The product, to be produced by Stallion Tech-



British firm The Force Ten Company has developed this Eezee Reader system to allow partially sighted people to use their existing TV set for reading newspapers, magazines and books. It consists of a 150 x 80 x 60mm base unit housing the electronics, plus a handheld scanner containing a miniature monochrome TV camera fitted with a fixed focus lens. The system provides a magnification of 40 times, expanding a 16mm wide section of the image to fill the screen. Further information is available from Scan Probe Australia, 237 Kesters Road, Para Hills, SA 5096.

nologies, will be exported to both European and United States markets.

For over two years, Datacraft have been a quality accredited supplier of Mid Range Protocol Boxes, to ICL in the United Kingdom. More recently, Fujitsu's Dandenong manufacturing facilities has commenced large scale manufacturing of Network Trunking Units. These units built jointly between Fujitsu and Datacraft, are being exported directly to the Hong Kong and Chinese markets.

SPACE STATION AGREEMENT SIGNED

NASA and the Russian Space Agency (RSA) have signed two significant documents which put the United States and Russian space cooperation on a firm basis and underpin Russian participation in the International Space Station program.

The two organisations signed an 'Interim Agreement for the Conduct of Activities Leading to Russian Partnership in Permanently Manned Civil Space Station' that provides for initial Russian participation in the International Space Station program.

The Interim Agreement will govern Russian participation until an Intergovernmental Agreement and a NASA-RSA Memorandum of Understanding can be concluded.

"This interim agreement is an essential step towards Russia's full participation in the International Space Station project. Just as the race to the moon defined the Cold War competition between the superpowers, the Space Station will define a new era of peace and cooperation for the world," said Daniel S. Goldin, NASA Administrator.

NASA and RSA also signed a separate US$400 million contract for Russian space hardware, services and data. Under this contract, NASA will purchase hardware and services from RSA and its subcontractors for approximately US$100 million per year through 1997, in support of a joint program involving the US Space Shuttle and the Russian Mir Space Station. The contract also covers early International Space Station activities.

AUSTRALIAN SWITCHES FOR JINDALEE RADAR

Telecom Australia has signed a contract with Magellan Industries, of Western Australia, for the design and production of 1467 calibration switches for the Jindalee Operation Radar Network (JORN).

The switches are a vital component of the network, being used to provide calibration signals and/or fixed terminations to the Receiver Front-End and the Receive Antenna Element.

Telecom Project Director, Mr Ron Dicker, said in signing the contract that Magellan Industries was selected because it could provide the best value product; he was very pleased that the successful contractor was Australian.

"Telecom has to deliver the best possible product at the best possible price to its customer," he said. "It is really exciting that these goals can now be achieved in Australia, using Australian designed and produced technology. Ten years ago we would have been forced to go overseas."

The Jindalee Operational Radar Network is the most advanced ultra long range surveillance system in the world; prime contractor Telecom Australia is pursuing export opportunities for the leading edge technology. ❖

NEWS BRIEFS

- ***TDK (Australia)*** has appointed Greg Scott as WA State Representative and Justin Whitehead as Promotions Manager.
- Russell Bate has been appointed Managing Director of ***Sun Microsystems Australia.***
- ***Emona Instruments*** has opened a Perth office, in Victoria Park at 63 Shepparton Road, on the corner of Harvey Street. Manager of the new office is Ray Domingo.
- ***A two day training course called Internetworking Design*** will be conducted by Independent Information Technology Training at Sydney, 7-9 December 1994 and Melbourne, 28-30 November 1994. For more details phone (02) 252 2844.
- ***NetComm Australia*** has appointed Bruce Reid as National Marketing Manager for Australia and New Zealand.
- Chris Milne has been appointed Managing Director of automotive electronics instrumentation specialist ***VDO Instruments Australia***, and is the company's first Australian MD. Former MD Egon Vetter has returned to Germany to take up a senior position with the parent company.
- ***A two day training course called Network Cabling Design*** will be conducted by Independent Information Technology Training at Sydney, 21-23 November 1994 and Melbourne, 16-18 November 1994. For more details phone (02) 252 2844.
- ***Hayes Microcomputer Products*** has appointed Eleonore Bondaruk as Sales and Marketing Co-ordinator and Ash Nallawalla as Marketing Support Specialist.

Product review:

California Instruments' 1251WP line power unit

Designed for operating and testing equipment at voltages or frequencies different to that of the local mains supply, this portable power converter unit uses efficient switchmode circuitry to deliver clean AC power complying to any of the common international standards.

by ROB EVANS

Electronic equipment manufacturers that aim for export markets, or produce gear designed for hostile or remote locations must take considerable effort to ensure that their product will meet its specifications when powered by the predicted mains supply. This can range in nominal values from 110VAC to 240VAC in several steps, have a frequency of 50Hz or 60Hz, and in the case of remote locations, both the voltage and frequency can deviate from the nominal rating by a significant degree.

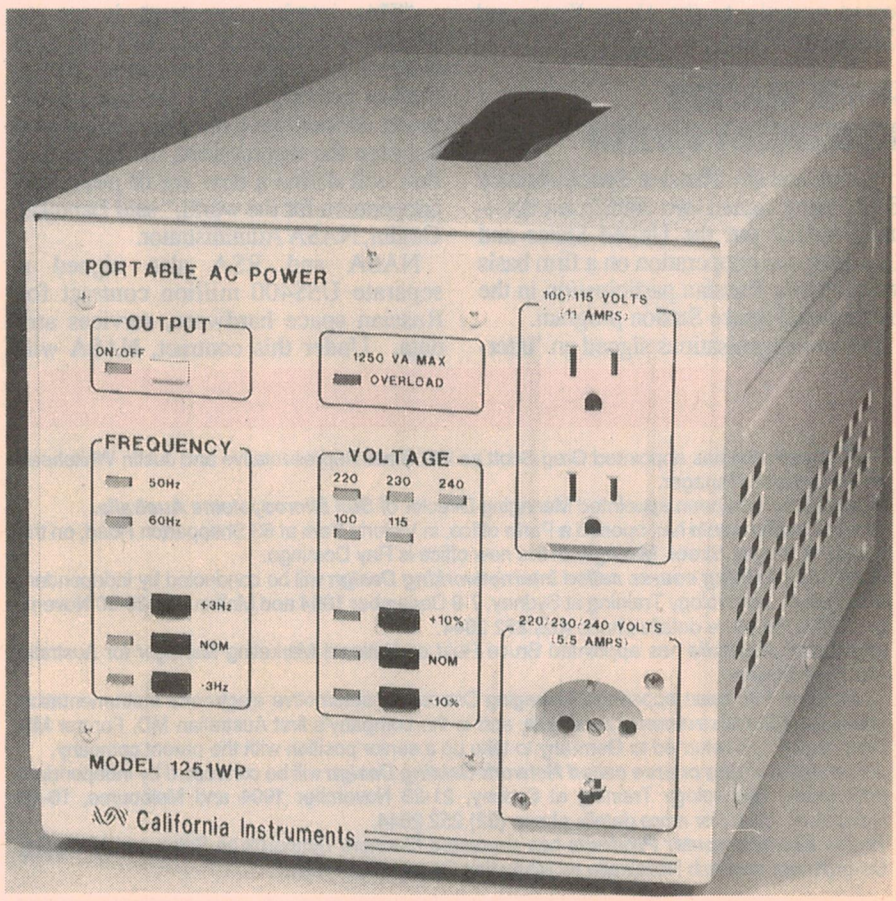
To check a piece of equipment's performance under these conditions the test supply is traditionally generated by a variac or auto-transformer, which simply scales the level of the local supply to the desired mains voltage, or the predicted voltage range. While this relatively inexpensive technique provides the required mains voltage however, the test supply's *frequency* is irrevocably tied to that of the local mains, leaving the equipment under scrutiny untested in this regard.

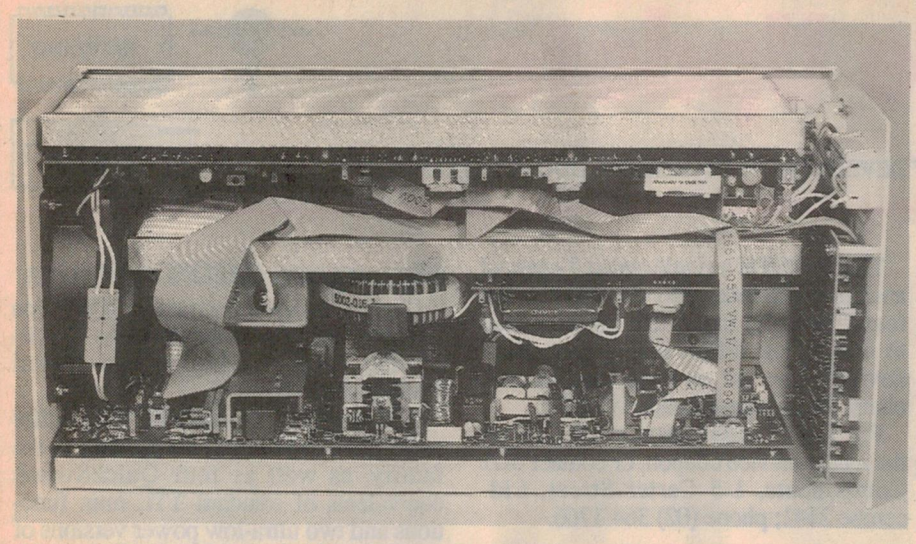
Generating a robust mains supply which operates at a specific frequency (that is, independent to that of the local supply) is no simple matter however, and in the past has involved driving a large power transformer with an equally husky power amplifier/oscillator circuit. Unfortunately, since this type of unit must produce a well regulated sine-wave output (so as to emulate the mains), the power amplifier/oscillator module needs to be quite linear in operation and is therefore relatively inefficient. This fact, coupled with the large power transformer(s) used in the circuit means that such a line power unit is invariably large, heavy, inefficient and very costly.

As you've no doubt gathered, the California Instruments model 1251WP line power unit shown here solves all of these problems in one hit — except perhaps for that of cost, as it's tax exempt price is an awe-inspiring $5250...

In all other matters though, the 1251WP power unit appears to be leagues ahead of its predecessors, and offers a healthy 1250VA of output power, a sine-wave output with less than 1% distortion, and a line/load regulation figure of around 2%. And thanks to the compact and efficient high-frequency switchmode circuitry used in the inverter stage, the unit measures only 222 x 216 x 444mm and weighs in at a modest 13kg — somewhere between portable and 'luggable', you might say...

In terms of capabilities, the 1251WP is also quite impressive. It can be set to a nominal AC output level of 100V or 115V (Low range), or 220V, 230V and 240V (High range), and the output frequency set to 50Hz or 60Hz. Also, as an aid to standard testing procedures the voltage can varied between preset levels of +/-10% (relative to the current setting), and the frequency shifted between +/-3% of the 50Hz or 60Hz settings.





The unit's internals, looking from the top. Note the three shallow-finned heatsinks and the large amount of circuitry involved.

The input circuitry of the power unit also appears to be quite flexible and sophisticated, and can cope with an input supply in the range of 85V to 264V AC; it includes an electronic control stage to limit the magnitude of the input current peaks. The idea here is to cause the least possible distortion (or disruption) of the input waveform, which can be particularly important when the power source is a precision or critical supply, or a standby or remote location supply with a limited peak current capability. This can be considered as power factor correction, in effect.

As further evidence of the circuit's elaborate design, the output stage can handle a short term overload of around three times its rated current capacity (useful for starting large electric motors, for example), and will then change to a constant current mode where the output voltage is reduced until the rated current limit is met — around 11 amps (RMS) on the low voltage range, and 5.5 amps on the high range.

As you would also expect from this type of design, the unit will shut down in the event of an output short circuit, a temperature overload, and an overvoltage condition at the input.

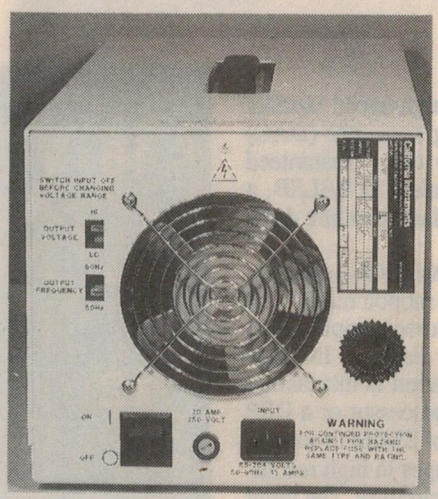
Using and testing

As you can see from the shots of the 1251WP line power unit the front panel layout is quite straightforward, and features several small push-button switches and a number of LED status indicators. As such, it's very easy to select between the voltage and frequency test offsets (+/-10% and +/-3%, respectively), and to toggle the AC output between its on and off states.

As the unit's output configuration should not be changed while it's actually operating however, the output frequency and high/low voltage selector switches are confined to the unit's rear panel, as can also be seen in the associated shots.

Curiously though, the facility to change the output voltage between the fine steps of each main range is only accessible from *inside* the unit. So to change the output voltage from say 230V to 240V AC, you need to turn the unit off, wait five minutes for the stored voltages to decay (as stressed in the operator's manual), remove the top cover (six screws), then reposition the DIP switch settings on the oscillator circuit board, and finally replace the lid and reapply power. Not a process for those in a hurry...

During this procedure though, we were able to check out the power unit's



The recessed voltage and frequency switches on the rear panel control the broad settings for the unit's output waveform.

internal construction, and as you can see from the relevant photo there's a surprisingly large amount of circuitry involved — and not a great deal of room to spare inside the case. Most of the electronics is held on three large circuit boards which mate to similarly sized extruded heatsinks, while the complete unit is cooled by a sizeable muffin fan located in the rear panel.

Despite its crowded internals though, the construction itself appears to be of a very high standard — as you'd expect from a piece of professional equipment in this price range — and we noted with some interest that the main PCB's carry a number of status indicator LEDs, to aid in faultfinding procedures.

We were happy to see that the relevant troubleshooting steps were quite well covered in the owner's manual, which helps the user interpret the state of the LEDs while the unit is operating and then decide which module may be at fault. Also, since all of the circuit's interconnections seem to be made via plugs and sockets (with no hardwiring involved), it should be quite a simple matter to change a complete module/heatsink assembly when rapid servicing is required.

You may also have noticed that the mains outlet sockets on the unit's front panel look rather different to those of a common domestic power point. This is because the two upper outlets supply AC power when the unit's *low* voltage range is selected (100V/115V), and therefore should match the plugs used on this gear, while the lower outlet is for the *high* range (220V/230V/240V) and should correspond to that type of gear.

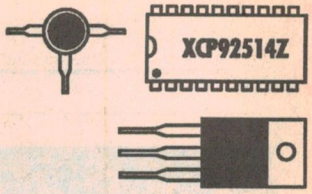
In the case of our review unit however, the lower socket was for the European market and did not suit standard Australian equipment. While we used an appropriate adaptor lead for our tests, the power unit would normally be supplied with a standard mains socket that suits our local conditions — in fact, the distributors will apparently fit whatever socket suits your needs, including a 'socket strip' unit which holds all of the main international types.

When it came to putting the 1251WP power unit though its paces on the test bench, it also delivered the performance that you would expect from this type of professional gear. Both the output voltage and frequency were very close to the selected figure (better than the stated 1% accuracy), and rock steady even at high power levels.

Furthermore, the output waveform was

Continued on page 116

Solid State Update



KEEPING YOU INFORMED ON THE LATEST DEVELOPMENTS IN SEMICONDUCTOR TECHNOLOGY

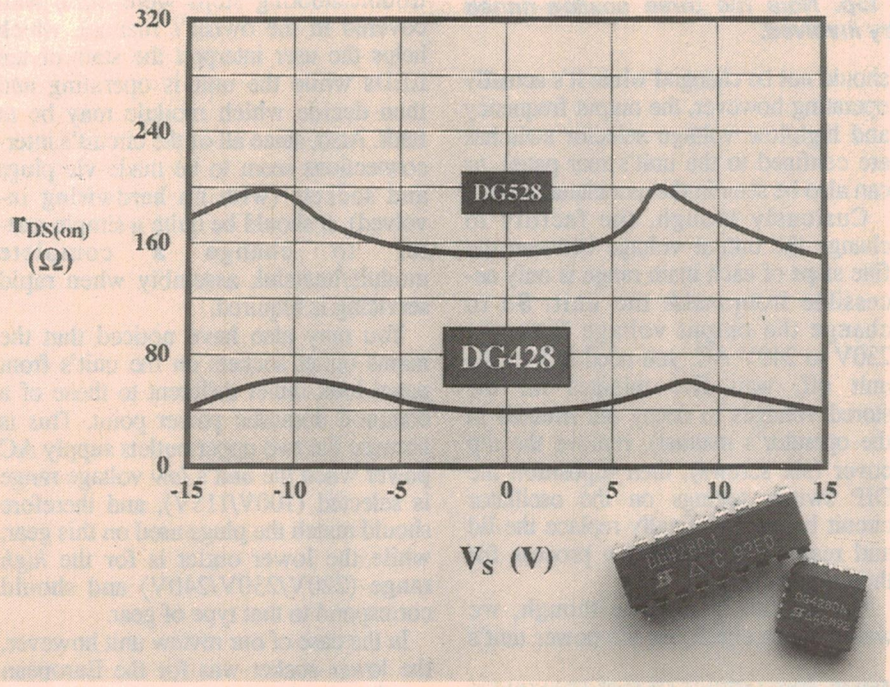
Latchable multiplexer

Siliconix has released the latest devices in its DG4XX series of multiplexers, the DG428 and DG429. These high speed latchable devices feature low power consumption and on-resistance.

Intended for signal selection and routing, the devices suit data acquisition, aerospace and other high performance systems.

The DG428 is a single ended 8-channel analog multiplexer and the DG429 has four differential inputs that can be routed to a common differential output. Both devices have an on-resistance of 100 ohms. Power consumption is 2mW.

For further information circle 278 on the reader service coupon, or contact IRH Components, 1-5 Carter Street, Lidcombe 2141; phone (02) 364 1766.



High speed CMOS switches

Quality Semiconductor Inc (QSI) has released eight new devices to its QuickSwitch family of high-speed digital CMOS switches.

The new devices add TTL '244 buffer and TTL '245 transceiver functions to the family, as well as four QuickSwitch equivalents of standard TTL mux functions and two ultra-low power versions of the company's bus-switch devices.

The new devices feature a five ohm on-resistance, a propagation delay of less than 250 picoseconds, negligible power consumption, and pin-compatibility with existing FCT logic products.

Packaging options include 20, 24 and 28-pin dual in-line (DIP), small outline IC (SOIC) and QSI's quarter size outline package (QSOP) configurations.

For further information circle 272 on the reader service coupon or contact Veltec, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

Analog switches and multiplexers

Maxim has redesigned its DG400 family of analog switches and multiplexers, giving improved characteristics to the devices.

The guaranteed on-resistance match between channels is two ohms, with a maximum variation of three ohms over the specified analog signal range. As

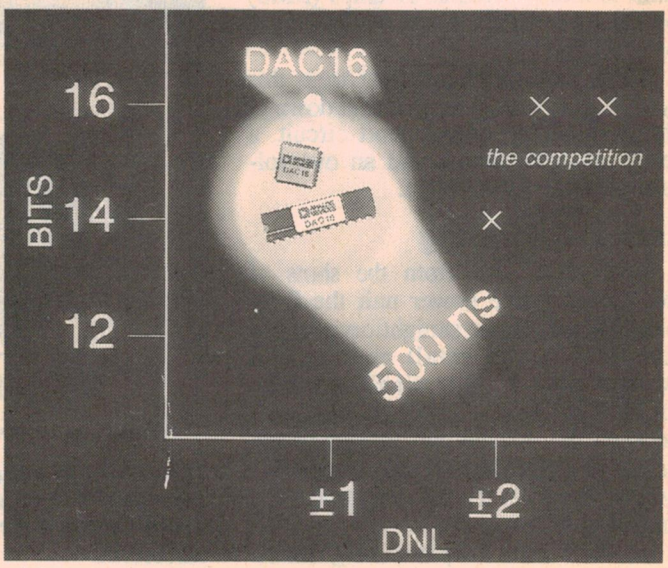
16-bit DAC is fast, quiet

The DAC16 from Analog Devices is a high-speed parallel input, current output 16-bit digital to analog converter (DAC) with very low noise, high linearity and low drift. Guaranteed specifications include maximum noise equivalent to 0.3LSB, a differential non-linearity error of +/-1LSB and temperature drifts of 0.025ppm/°C.

It has a settling time of 500ns and draws 190mW to produce a 5mA full scale output with guaranteed 16-bit monotonicity. The device is intended for high speed, high-accuracy applications such as communications, ATE and graphic displays. In communications equipment, where digital modulation is increasingly common, the device interfaces to a microprocessor or a DSP to produce analog waveforms at frequencies of 2MHz or more.

The DAC16 can enhance the quality of images in high resolution graphics when used in deflection control circuitry. The input bus is 16-bit parallel and is TTL/CMOS compatible.

For further information circle 276 on the reader service coupon, or contact NSD Australia, 205 Middleborough Road, Box Hill 3128; phone (03) 890 0970.



well, the devices have a low leakage over temperature and ESD protection greater than 2kV.

The devices are fabricated with Maxim's 44V silicon-gate process, and feature rail-to-rail signal handling. They are TTL/CMOS logic compatible and can operate from a single +10V to +30V supply, or from bipolar +/-4.5V to +/-20V supplies.

For further information circle 273 on the reader service coupon or contact Veltec, 18 Harker Street, Burwood 3125; phone (03) 808 7511.

Enhanced parity checking DRAMs

Toshiba has announced a strengthening of its line-up of advanced DRAM products with the addition of new four and 16-megabit DRAMs with enhanced parity error checking.

The new devices provide the key component of the parity checking systems that are becoming an integral part of memory intensive workstations and high end personal computers. Using the dedicated chips in memory systems reduces the overall chip count and the area required for the memory.

In parity checking, the accuracy of signals passing into and from each individual DRAM along its column address strobe (CAS) data pathway is compared against the parity bit held by an additional chip, to assure signals are free of error. Toshiba's new devices incorporate four CAS, allowing a single device to monitor up to four memory chips.

For further information circle 280 on the reader service coupon or contact Toshiba Australia, PO Box 350, North Ryde 2113; phone (02) 887 3322.

3.3V PLDs

Lattice Semiconductor has released two 3.3V programmable logic families (PLD), the GAL16LV8ZD and GAL20LV8ZD, which the company claims are the world's fastest low-voltage, low power PLDs. The devices are aimed at high-performance, battery-powered applications such as portable computers and personal digital assistants.

Devices from both families interface with 3.3V and 5V logic levels, making them compatible with either pure 3.3V or mixed 3.3/5V systems. The current consumption of the devices is typically 45mA while running at a clock speed of up to 62.5MHz. This is around half the power of comparable 5V devices. A power down feature controlled by a dedicated pin reduces the current consumption to 50uA.

For further information circle 275 on the reader service coupon, or contact Zatek Components, 1059-1063 Victoria Road, West Ryde 2114; phone (02) 874 0122.

DC restoration IC

Burr-Brown's new SHC615 is a DC restoration device for video, high speed and precision applications. Designed to stabilise the performance of RF signals, the device is also useful for other applications such as a fast phase comparator, a synchronous demodulator in PLL circuits, or an RF pulse code modulator/demodulator.

The IC can be configured as a sampling comparator, with high impedance differential inputs, current source output, and a fast switching stage with TTL/CMOS compatibility.

Key specifications include 280MHz bandwidth, 2.2ns propagation delay, 1700V/us slew rate, 4nV/√Hz noise and 600mW maximum power dissipation. The device comes in a single 14- pin DIP or SOIC package, or in die form.

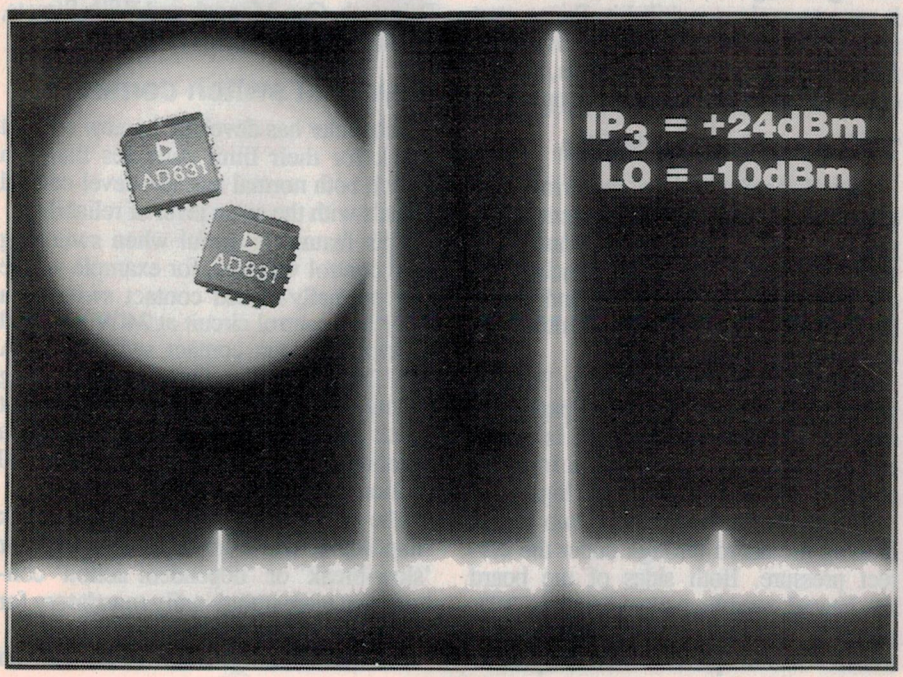
For further information circle 277 on the reader service coupon, or contact Kenelec, 2 Apollo Court, Blackburn 3130; phone (03) 878 0824.890.

Low distortion 500MHz mixer

The AD831 from Analog Devices is an RF mixer that features a low distortion over a 500MHz bandwidth. This makes the device suited to demanding applications such as digital mobile radio basestations, high-performance HF receivers and military equipment. Although Analog Devices' products have been used in RF applications for some years, the AD831 is the first product specifically designed for this market.

The mixer is usually the key component in determining the performance of an HF receiver, and obtaining a low distortion (needed for selectivity and sensitivity) requires a high power local oscillator (LO). This causes isolation and interference problems, as well as increasing the power consumption. The AD831 requires only -10dBm of LO power.

For further information circle 271 on the reader service coupon, or contact NSD Australia, 205 Middleborough Road, Box Hill 3128; phone (03) 890 0970.



NEW PRODUCTS

Surface mount crystal oscillator

Hy-Q has added a new voltage controlled crystal oscillator (VCXO) to its range of products. The J-VCXO is a low profile surface mount device of hybrid design using a ceramic substrate instead of the usual PCB approach. This has allowed the height of the device to be kept to a minimum, while still ensuring it is suitable for infrared reflow soldering.

The dimensions of the device are 21 x 15 x 4.5mm, with a 16-pin DIL compatible footprint. It can operate over a temperature range of -40 to 85°C with a frequency stability of +/- 20ppm. It has a frequency adjustment of +/-200ppm for a control voltage of 0 to +5V and a modulation bandwidth of DC to 100kHz. The output characteristic is HCMOS compatible and can drive up to 50pF from a 5V supply. Current consumption is typically 5mA in normal mode, and 250uA in standby mode. The nominal frequency range of the device is 10MHz to 40MHz.

For further information circle 241 on the reader services card or contact Hy-Q International, Private Bag 100, Rosebank MDC, Clayton 3169; phone (03) 562 8222.

Cordless drill

Panasonic has announced its new Predator Series of cordless drill/drivers. The series consists of a 12V unit and two 9.6V drill/drivers, which are claimed to be very compact and lightweight, due to technology advances.

Part of the size reduction is due to smaller battery cells which have decreased in size by 20%. The tools have been reduced in size by up to 16%, and are up to 20% lighter than previous models. The series all have a 22 stage clutch, 21 separate torque settings and a drill setting for maximum torque.

The new models can use Panasonic's 15 minute 'Coffee Break' charging system and have a keyless drill chuck with a self-tightening mechanism which makes it easy to replace a drill bit. Prices start from $419 and the drills are available from specialist power tool outlets, electrical wholesalers and plumbing suppliers.

Expanded range of diecast boxes

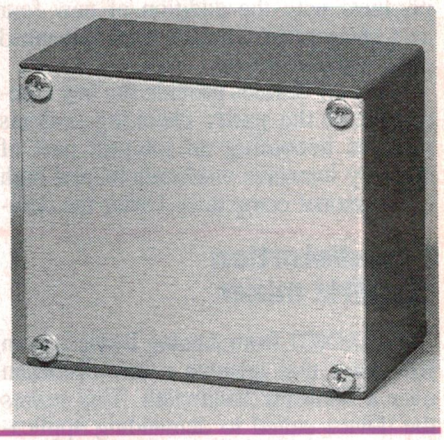
ITT Pomona has expanded its range of rugged and sealed aluminium alloy diecast enclosures, intended for housing sensitive electronic assemblies, pneumatic, hydraulic and electrical devices in commercial and industrial environments. The boxes provide a high degree of EMI/RFI shielding, and also resist atmospheric and marine corrosion.

Wall mounting holes and lid fixing screws outside the sealing area prevent moisture and dust contamination. The lid incorporates a recessed neoprene gasket to resist oil and petroleum-based fluids from seeping inside.

Bosses on the inside base of the enclosure allow PCBs to be fixed horizontally, or connection of earth grounding, terminals, etc. Internal guide slots also allow vertical mounting of PCBs. All enclosures are available in natural or painted finishes, and either plain or with BNC connectors fitted.

Box sizes range from 57 x 29 x 22mm up to 222 x 146 x 55mm, with the most recent addition measuring 90 x 36 x 30mm. This model is available both plain and with two alternative BNC connector combinations: female to female, and female to male.

For further information circle 250 on the reader service card, or contact KC Electronics, Suite 3, 888 Doncaster Road, Doncaster 3108; phone (03) 848 1266, or fax (03) 848 1799.



TTS machine for PCBs

The Superfuser is a machine that automates the toner transfer system (TTS) process. The idea is to insert a blank PCB with the imaged TTS paper attached (on one or both sides) in one end, and after a few minutes, have it emerge the other end and drop into a bowl of water.

It can handle boards up to 300mm wide, but is limited by the TTS paper size of 215 x 279mm. The unit is small enough for desktop use, with a footprint of 430 x 140mm and is 115mm high.

Internal to the machine are two rollers feeding the board through under the correct pressure. Both sides of the board are heated, enabling two pieces of TTL paper to be attached for a double sided transfer in one pass. A relatively slow transfer speed of 1.5mm/second gives complete toner fusing. Heat transferred along the board prevents lifting of the emerging TTS.

For further information circle 250 on the reader service coupon or contact Palmtech, Cnr. Moonah and Wills Streets, Boulia 4829; phone (077) 463 109.

New limit switch contacts

Schneider has developed a new contact block for their limit switches that can switch both normal and low-level control signals with the same level of reliability.

This feature is useful when switching dual control voltages, for example where one normally-closed contact switches a relay in a control circuit at 240V AC, and a normally-open contact switches 5mA 24V DC to a PLC to perform a signalling function. The new XES-P2151 contact block can perform both functions with a reliability of less than one failure in 100 million operations.

The contact has a true positive break snap action and eliminates the need for 'slow-break' or 'dependent action' contacts that were traditionally mandatory for safety circuits on machines.

For further information circle 243 on

the reader service coupon or contact Schneider P/L, Block Q, Regents Park Estate, Princes Road East, Regents Park 2143; phone (02) 743 7700.

Tunable active filters

When sampling an analog signal, data must be sampled at a frequency equal to or greater than the Nyquist rate to avoid aliasing errors. On the other hand, oversampling results in more data than necessary, reducing the efficiency of the data transfer.

A range of tunable active filters from Datel provide signal conditioning up to 200kHz, allowing the sampling frequency to be tuned to the Nyquist rate, and hence fully specifying the input signal. The filters are microprocessor, voltage or resistor tunable and all filter types are available. They are used in digital test systems, spectrum analysis, DSP and medical telemetry.

For further information circle 244 on the reader service coupon or contact Quiptek Australia, PO Box 738, Mordialloc 3195; phone (03) 558 0122.

Shears make good scissors

Scope Laboratories has released its new spring loaded, 170mm shears which can be used as electronic wire cutters, garment trade utility shears or florist's trimming scissors. The model number is WS-170 and the shears are part of the Scope range of specialised electronic/PCB cutting tools and needle point pliers.

For further information circle 242 on the reader services coupon or contact Scope Laboratories, 3 Walton Street, Airport West, Melbourne 3042; phone (03) 338 1566.

1000W switching power module

Adding to Lindmark's range of switching power modules, the PSP 1000 allows users to build custom switchmode power supplies with up to 1000W output. These modules incorporate all the complex and difficult to design circuitry for switching power supplies, considerably simplifying the job of designing a power supply.

The PCB mount PSP 1000 module measures 70 x 110 x 36mm, with an efficiency of over 96% at full load. The module incorporates 4500V isolation for the control input, which provides good regulation with simple feedback circuits.

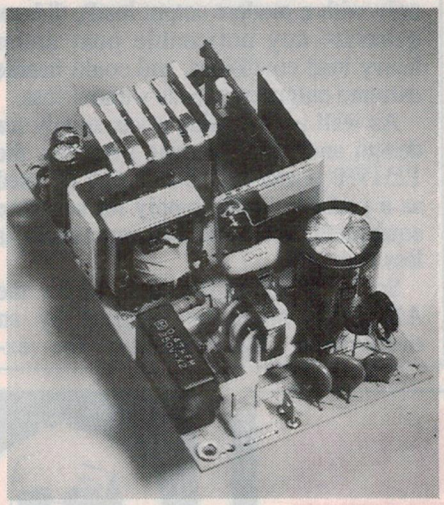
These modules contain an LC series resonant mode, parallel loaded inverter, using MOSFETs. They contain no electrolytic capacitors, and employ surface mount technology. They are encased in cast aluminium, sealed under vacuum with a special thermal epoxy resin, and are thus practically insensitive to humidity and vibration.

A 63 page handbook is available giving detailed theoretical and practical advice on using the Lindmark modules to construct switching power supplies.

For further information circle 270 on the reader service coupon or contact Advanced Solutions, 47 Karril Avenue, Beecroft 2119; phone (02) 872 1981.

Tiny 40W power supply

Kepco has released a 40W switchmode power supply with a footprint measuring around 75 x 125mm (3" x 5"). The new models, called KRW, produce +5V or +3.3V as the principle output. The +5V version includes +/-12V or +/-15V.



The supplies are designed to fit into crowded assemblies and can operate from an input supply ranging from 90 to 264V AC. A class B input EMI filter is included in the design.

For further information circle 249 on the reader service coupon or contact Obiat, 129 Queen Street, Beaconsfield, 2015; phone (02) 698 4776.

Power supplies from Finland

Amtex Electronics has introduced a new range of over 50 different types of power supplies and battery chargers from Powernet in Finland. The units cover the range from 60 to 275W. Input voltages are jumper selectable and output voltages range from 4.2-5.5V to 45-48V DC. The units can be connected in series or in parallel for added power. They are available in DIN, bench and wall mounted types, with a nominal size of 215 x 110 x 80mm, and weigh about 1.3kg.

For further information circle 248 on the reader service coupon or contact Amtex Electronics, 13 Avon Road, North Ryde 2113; phone (02) 805 0844. ❖

Line Power Unit

Continued from page 111

quite clean and showed no evidence of switching artifacts (the switchmode circuitry apparently operates at 31.5kHz). It only suffered waveshape distortion when the unit was running in its constant current mode — that is, overloaded. This limiting action occurred when the output current reached about 5.1 amps (at 240V AC) by the way, which was slightly less that the rated figure of 5.5 amps.

Due to the 1251WP's elaborate protection facilities, the unit should happily operate in just about any location and with a wide range of 'mains' supplies. We found that it could operate with an input voltage as low as 55V AC (but only with a modest output load), did not generate any noticeable heat under heavy load conditions, and could handle extreme output overloads without fuss.

As well as providing a test supply for design and manufacturing purposes, the 1251WP power unit could also be used as a portable mains supply for sensitive equipment, when the existing supply is less than ideal.

So in a remote location where the AC mains might be supplied by an overworked AC generator for example, the 1251WP could be used to provide a clean and stable supply to the critical gear.

While servo controlled auto-transformers are often used in this application, they tend to be quite large (that is, not really portable), are slow to respond to changes in input and output conditions, and significantly, offer no control over the mains frequency.

Despite the four-figure price tag then, US-based California Instruments appear to have produced a line power unit that is superior in all respects to those using past technology.

According to their brochures the company is very experienced in manufacturing this type of gear, and has been supplying the military and commercial avionics industry with precision power equipment for around 25 years. It may well be that the world's shrinking military budgets have prompted this assertive company to make inroads into more domestic markets...

The local distributor for California Instruments products is Obiat Pty Ltd of 129 Queen Street, Beaconsfield NSW.

For more information on the 1251WP power unit or other models in the California Instruments range, write to PO Box 37, Beaconsfield 2015, call (02) 698 4776, or fax (02) 699 9170. ❖

Special Feature:

New Test and Measuring Instruments

Compact GPS for adventurers

Panasonic's new KX-G5520X is a compact (13 x 6.5 x 3.5cm) handheld global positioning system (GPS) receiver featuring portability and easy operation.

This five-channel C/A code receiver stores up to 99 way-points and nine reversible routes, and will display position in either latitude, longitude or UTM (universal transverse mercator).

The receiver is powered by an AA alkaline battery pack. A lithium battery serves as a memory back-up and a nickel metal hydride rechargeable battery is available as an option.

The pocket-size GPS is suited to boating and four-wheel drive enthusiasts as well as serious hikers. It's designed to withstand the rigours of adventure, is splash resistant and features a backlit LCD so it can be read in the dark.

It comes with a carry strap and AA battery case. Options include an AC adaptor, soft carry case, external antenna, DC adaptor and adjustable mount. The recommended retail price of the KX-G5520X is $995.

For further information circle 205 on the reader service coupon or contact the Panasonic Customer Care Centre on 132 600 from anywhere in Australia.

3-1/2 digit AC clampmeter

The MIC 2060CP 3-1/2 digit AC clampmeter from Quiptek Australia features peak detect to hold the maximum RMS value of voltage or current, data hold which freezes the reading for 10 seconds, auto power-off to save battery life and audible continuity check.

The instrument has two AC current ranges: 200A and 600A. The meter also offers voltage and resistance ranges similar to a digital multimeter. It has full overload protection on all ranges, a large 12.5mm-high LCD display readout and a battery-low indication.

For further information circle 202 on the reader service coupon or contact Quiptek Australia PO Box 738, Mordialloc, 3195; phone (03) 558 0122.

Multimeter is also a data logger

The Norma 900 series of digital multimeters from Testing and Certification Australia comprises five models. Two are average reading and three are RMS reading. Features common to all models are selectable measurement rate, temperature measurement, actual current display when using a current transformer, bargraph, data hold, auto/manual ranging, auto off and optional RS-232 interface with data acquisition software.

The 900 series offers high accuracy and rugged construction. A high capacity HRC fuse protects the operator, and the RS-232 interface is electrically isolated for safety. Each instrument is supplied with a protective holster which is resistant to shock, heat, solvents and oils. Several models include display illumination.

Features available include max/min storage, peak store, user definable max/min limits, capacitance, frequency, count, relative measurements, dB, bargraph zoom and centre zero. The instruments are designed and manufactured to AS3901, and are covered by a three year warranty, backed by TCA's NATA accredited laboratories. Customers can have their instrument supplied with a traceable NATA calibration report.

For further information circle 203 on the reader service coupon or contact Testing and Certification Australia, 14 Nelson Street, Chatswood 2067; phone (02) 410 5180.

New 60MHz DSO from H-P

Hewlett-Packard has expanded its 54600 range of reasonably priced digital oscilloscopes, with the instroduction of the new two-channel HP 54603B.

The new model offers 60MHz bandwidth and is designed to meet the test and measurement needs of students in university engineering labs and classrooms. It provides features and ferformance characteristics commonly found in industrial scopes, yet is priced at only $3100. An even lower price is available to engineering schools with tight budget constraints, via H-P's educational discount programme.

Features include a display update rate of 1.5 million points per second, for 'analog look and feel' response to control panel adjustments and signal changes. In vector mode the refresh rate is a constant 60 screens/sec, regardless of the number of waveforms displayed. An en-

hanced vector display changes trace intensity to indicate signal slew rate, allowing fast visual interpretation.

As with other models in the 54600 series, the 54603B provides autoscaling for faster setup, can be provided with additional functions via plug-in modules, and can be connected to a PC via H-P's BenchLink/scope software.

Each HP 54603B comes with two probes, operating and service manuals, and a power cable. Further information is available from H-P's Customer Information Centre by phoning 13 1347, extension 2902.

ELF/VLF field strength meter

The Holaday HI-3604 is a portable field strength meter for measuring ELF/VLF electric and magnetic fields. It provides the engineer, or the health and safety professional, with a sophisticated tool for investigating low frequency power environments.

Designed to cover the frequency range of 50-1000Hz, the meter is able to evaluate both magnetic and electrical fields associated with power lines and electrically operated appliances, such as video terminals.

The large LCD display presents the information in milligauss, gauss, volts/metre and kilovolts/metre. A bargraph analog display helps locate 'hot spots' and field orientation.

The meter also features autoranging and sealed membrane switches, making it ideal for field use. A built in data logging facility enables the instrument to store up to 127 readings for future recall. Both H and E sensors are combined in the one probe. The HI-3604 is handheld, battery operated and covers the range 0.1 milligauss to 20 gauss for magnetic fields and 1V/m to 200kV/m for electric fields.

For further information circle 204 on the reader service coupon or contact Tech-Rentals, PO Box 621, Ringwood 3134; phone (03) 879 2266.

Data capture chart recorders

Two new chart recorders have been released by Astro-Med. The Dash-IV is a four channel recorder and the Dash-8 has eight channels.

Features include eight hour operation from internal rechargeable batteries, 300dpi printer resolution, data capture with 256KB RAM per channel, stackable data records and archival capability to floppy disk. As well, the recorders have a bright display for monitoring real time waveform activity and simplifying set up, and built-in differential inputs that accept AC or DC signals from 50mV to 250V. Plug-in modules allow the user to carry out thermocouple, high voltage, current or DC bridge measurements.

For further information circle 206 on the reader service coupon or contact Metromatics, PO Box 315, New Farm 4005; phone (07) 358 5155.

Handheld PCB shorted-track locator

Huntron Instruments have released a new Shortrack Locator, model ST90 that operates with any of the Huntron signature trackers by using an inductive probe to follow the tracker current and quickly locate low impedance shorts.

The instrument can find a solder

Continued on page 120

Device to catch power thieves

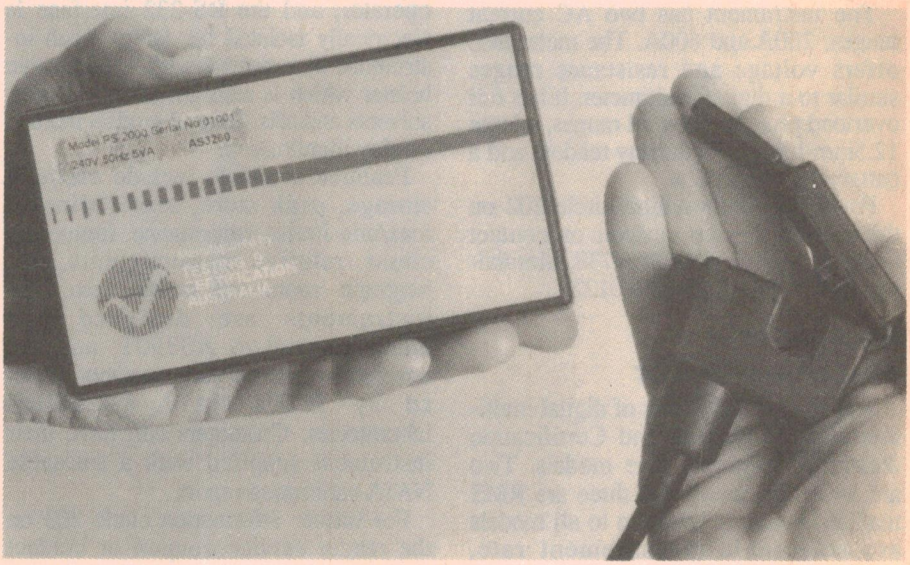
This unobtrusive device, called the Power Sleuth, is designed to catch out power thieves. Made and designed by manufacturers Testing and Certification Australia, the Power Sleuth is a sophisticated logging device which measures and records actual power used. When connected on the supply side of a customers meter, it can effectively confirm if power is being stolen.

The unit measures 38 x 83 x 143mm, making it easy to conceal and install. The unit can be located at the rear of the consumer's meter board, at the point of cable entry or on the pole outside the consumer's premises.

Stored data can be recovered on site using a laptop PC, or the unit removed and interrogated back at base. PC-based software provides energy analysis, graphical and tabular display of power usage, and the data can be exported to various spreadsheets like Lotus and Excel.

The device includes a pulsing output which interfaces with the Itron ERT RF meter module. This allows the Sleuth to be interrogated from the bottom of the pole, or even from a suitably equipped vehicle.

For further information circle 201 on the reader service coupon or contact Testing and Certification Australia, 14 Nelson Street, Chatswood 2067; phone (02) 410 5180.



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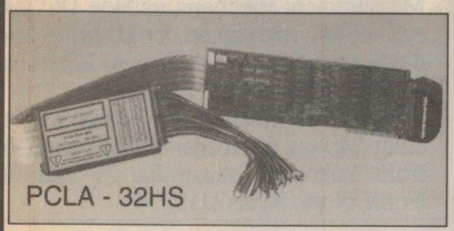
READER INFO NO. 34

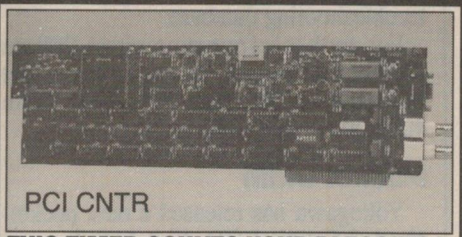
PCLA -32HS LOGIG ANALYSER... FOR THE SERIOUS CARD PLAYER


PCLA - 32HS

Boston Technology introduces the PCLA-32HS Logic Analyser for serious analyser users that demand high level performance.
Its advanced **Multiway Trigger** has the power and flexibility to tackle your demanding digital problems. The Multiway Trigger is a highly programmable state machine allowing 64 unique Match Conditions. Complex trigger definitions are made simple by combining groups of physical inputs into **Logical Signals** which can be counted, timed or monitored. The PCLA-32HS Logic Analyser boasts superior performance, powerful trigger, operating ease, quick response and clear information display.

Features:

- 32 data channels at 50MHz or 100MHz on 16 channels
- 4K/8K sample buffer per channel
- All functions Software controlled
- Comprehensive post-acquisition processing and display.

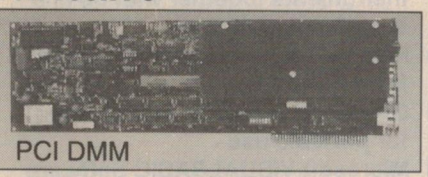

PCI CNTR

THIS TIMER COUNTS YOUR BLESSINGS

The PCI CNTR is a 2-channel 80-MHz counter/timer which provides the user with all the features that you would expect from a conventional GPIB counter/timer, without the use of mechanical knobs and switches for operation. Operation of the PCI CNTR can be accomplished in one of two modes, manual or programmed. Channels A and B are connected to the PCI CNTR through two BNC connectors. The counter/timer exhibits a 160mV sensitivity at all input ranges, and provides Reset, External Clock Input and Clock Output via a 9 pin 'D' connector.

Features:
• Frequency, Pulse Width, Period, and Count measurements • 8-Digit Display Resolution • 1ppm and 100ppm Models Available • 2 Input Channels • 80MHz Frequency Range (Channel A) • 100MHz Frequency Range (Channel B) • External Clock Input • AC or DC Input Signals accepted • Easy Programming Instructions for Auto Operation.

FULL 4½ DIGIT ACCURACY - DITIGAL MULTIMETER TECHNOLOGY FOR YOUR PC


PCI DMM

The PCI DMM provides digital multi meter capability for your PC. This high resolution instrument can operate in one of two modes, either manual or programmed, similar to GPIB local and remote operations. The PCI DMM can be left unattended whilst in program mode controlled by the PC, to acquire up to 999,999 readings at rates from .5 seconds to 99.99 minutes per reading.
Flexibility of data logging for the PCI DMM allows data to be stored into a user specified ASCII file, which can be easily imported into a variety of spreadsheet packages.
Features:
• Full 4½ Digit Accuracy • 12 Ranges plus Auto-Ranging • Measures AC/DC Voltage, Current and Resistance • Fully isolated from the host PC • Automatic data logging • Background (TSR) Operation • 0.03% - 1 Count Accuracy (DCV & Ω) • 2.5 Readings/Second Conversion Rate • Easy Programming Instruction for Auto Operation.

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PO Box 1093
West Perth WA 6872
Australia
Tel: (09) 321 2899
Fax: (09) 321 2891

READER INFO NO. 35

TEST AND MEASURING INSTRUMENTS

Continued from page 118

splash on a PCB, a shorted capacitor, or a failed electrolytic capacitor.

For further information circle 207 on the reader service coupon or contact Metromatics, PO Box 315, New Farm 4005; phone (07) 358 5155.

PC interface for signature analyser

A new digital storage interface unit, model DSI700 from Huntron Instruments is now available to enhance the performance of the Huntron Tracker 2000. The interface allows the Tracker to work with a PC to control test-routine generation, and storage of signatures for comparison testing.

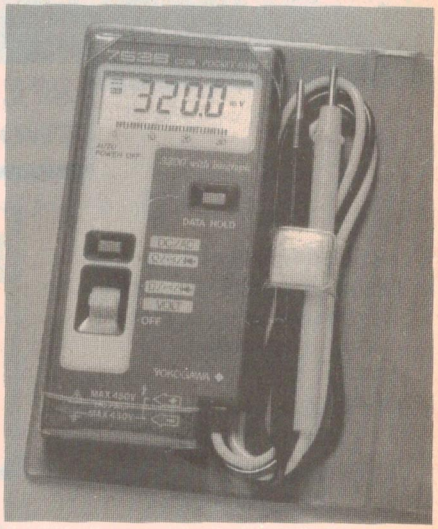
The DSI700 operates in semi-automatic or manual mode (with or without a PC) in conjunction with the Tracker 2000, to scan electronic components and determine the analog signatures of each pin. These can then be compared to components on a known good board.

Working with a PC allows the Tracker to instantly scan components that have up to 128 pins, and to learn and store signatures, creating a permanent troubleshooting database.

For further information circle 208 on the reader service coupon or contact Metromatics, PO Box 315, New Farm 4005; phone (07) 358 5155.

Pocket DMM

Yokogawa has released a new pocket-sized 3.5-digit LCD digital multimeter which provides a 3200 count plus 32-segment bargraph display. The 7536 03

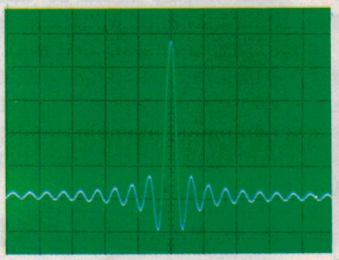


DMM measures only 106 x 51 x 10mm, and weighs approximately 110g including batteries and vinyl-covered case. The measurement system used is dual integration, and the meter has built-in test probes.

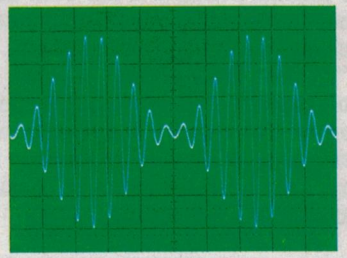
The DMM's ultra compact size and ability to be operated using one hand make it very convenient and versatile. Features include high speed sampling (12 times/sec for bargraph), auto ranging, data hold and auto power off. Measurement functions include DC and AC volts, resistance, continuity and diode test. Power is from two LR-44 or SR-44 1.55V 'button' cells.

Further information is available by circling 240 on the reader service card, or from Yokogawa Australia, 25 Paul St North, North Ryde 2113. ❖

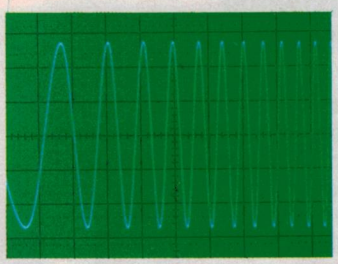
There are many areas where our function generator will surpass your expectations.



A built-in 12-bit, 40 MSample/sec, 16K deep arbitrary waveform generator easily handles your custom waveform needs.

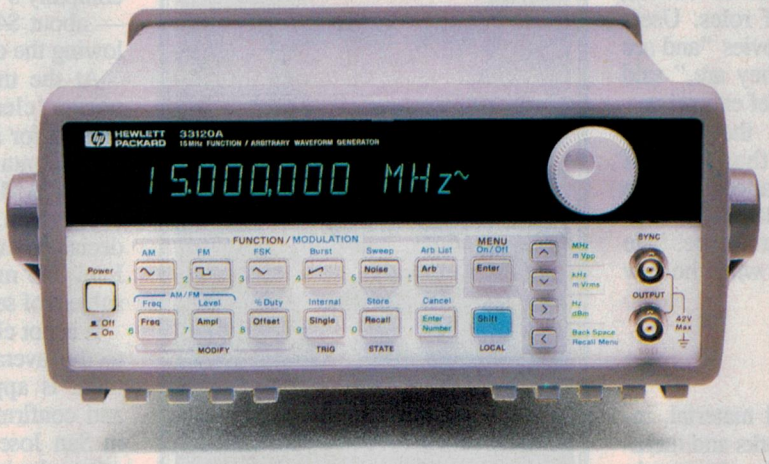


Internal AM, FM, FSK and burst modulation eliminate your need for a second modulation source.



Both linear and log sweeps are built in, making filter and amplifier testing quick and easy.

At a price that falls below them.



The HP 33120A 15 MHz synthesised function/arb generator: Within budget, without compromise.

In the world of function generators, price and performance have always been synonymous. So it's understandable you'd expect to pay more for the measure of confidence you get with a synthesised signal source that delivers stable, accurate signals test after test. Or, for the flexibility to generate complex waveforms with arbitrary waveform capability.

You'd probably also expect to pay a premium for the convenience of built-in sweep and modulation functions. And to have both HP-IB and RS-232 interfaces standard.

Fact is, you can always get high performance with the high price to match. Or, order the HP 33120A fully loaded function/arb generator and get something totally unexpected. A price you can afford.

Call HP to see how much function generator you can get for your money.

Discover just how easy it is to afford a fully loaded 15 MHz function/arb generator with synthesised signal source and arbitrary waveform capability. Once you hear the price, we think you'll agree it's the best deal of any function generator in its class.

In fact, you can learn more about the HP 33120A function/arb generator's custom waveform capability, signal accuracy, easy programmability and any other specifications you may need to make the right decision.

So call our Customer Information Centre on **13 1347** (Australia wide) and ask for extension **2902.**

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Silicon Valley NEWSLETTER

Clint Eastwood CD on its way

Fans of Clint Eastwood have a great new incentive to invest in a PC with CD-ROM capability, as Starwave, a company owned by Microsoft co-founder Paul Allen announced it is working towards the released of a CD-ROM featuring the life and films of Clint Eastwood — the first interactive career retrospective of a movie star.

The CD, for IBM compatible and Macintosh computers, is expected to be out in the first half of next year. It will include film clips, sound bites, photos and interviews made exclusively for the Starwave disc. The CD will organise Eastwood's career by types of movies, time periods and kinds of roles. Users will be able to take two movies "and see how different or similar they are," said Mike Slade, Starwave's chief executive.

Slade said he expects the disc to offer clips from more than half of Eastwood's 50 film appearances (he also directed 17 pictures). The actor agreed to the project after seeing a prototype. "He was really excited about it when he saw it," Slade said.

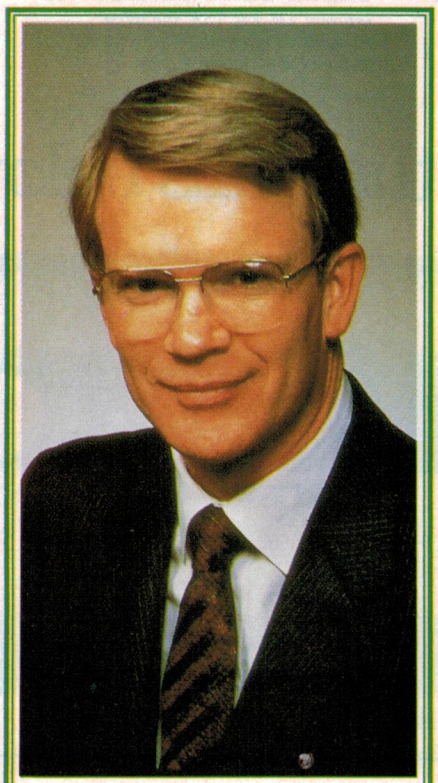
US copyright laws to be adjusted

Increasingly, copyrighted material, including music, video, artworks and literature is disseminated via electronic multimedia computers and networks. The US Commerce Department has now released its proposals for rewriting copyright laws to protect the creators of books, recordings, movies and other forms of information in the digital age.

A key recommendation calls for outlawing the use of technologies that allow hackers to pick the 'electronic locks' that copyright owners place on their works. Industry groups have said there is a pressing need for such measures, in light of the growing use of computers and computer networks that can easily copy and disseminate text, pictures, sound and video images in digital form.

Another major concern addressed by the Commerce proposals is the ability of computer users to transmit copyrighted digital music and other recordings over the Internet network. It has been unclear whether current copyright law covers such acts of copyright infringement.

"If we don't make it clear you can't transmit a work without the permission of the owner, copyright owners aren't going to use the information highway," said Bruce Lehman, Assistant Secretary of Commerce.



Ed McCracken, president and CEO of high tech graphics workstation specialist Silicon Graphics, has been appointed co-chairman of President Clinton's private sector task force, which will advise the White House on its information superhighway initiative.

Courts are just now starting to deal with the issue of digital copyright infringement. Computer networks are hardly the first technological challenge to copyright holders. The debate is similar to the controversies in past decades, surrounding the use of copy machines and audiotape recorders. But those technologies hindered pirates in important ways. Copies could be time consuming and expensive to make, and of lower quality than the original. But digital equipment can be used to easily and speedily reproduce virtually identical copies of material, ranging from sound recordings to data-base indexes.

Microcode snafu costs AMD US$34M

Advanced Micro Devices has agreed to pay shareholders US$34 million to settle five class-action shareholder lawsuits. The Sunnyvale chip maker was sued after disclosing in September that it had a problem with the microcode software designed into some of its advanced microprocessor chips. The company's stock dropped roughly 12% — about $4 a share — in the week following the disclosure.

At the time AMD said that the supposed 'clean room' microcode being created for its 486-type chips might have been contaminated with microcode to which AMD did not have clear title. Since them, AMD has won other court decisions that gave it the right to use the Intel 386 microcode which has been the subject of several legal battles.

It is not clear how much money will go to the average shareholder if the settlement is approved by AMD's directors and confirmed by the US District Court in San Jose. The court first must determine who is eligible for inclusion.

AMD spokesman Chuck Mulloy said the out of court settlement will have no significant impact on its next quarterly earnings. The payout will be offset by reserves, insurance and proceeds from another lawsuit involving Intel.

Quantum wants Digital's drive business

Having already passed Seagate Technology in sales, Quantum may be about to get a lot bigger yet as the Milpitas disk drive maker is negotiating with cash-hungry Digital Equipment to take over that company's disk drive business.

If the sale goes through Quantum will be able to expand its presence in the fastest growing part of the disk drive market — that for high capacity devices — by taking over a new Digital factory in

Malaysia and by having access to an advanced recording head technology developed by Digital engineers.

Digital and Quantum released separate statements confirming reports that they were talking about a sale, but declined to disclose specifics about negotiations including price and timetable. Digital's disk drive business is estimated to be worth US$1.5 billion a year.

Analysts said they expected Digital to sell operations amounting to about half of its entire disk drive business, a product line that includes small PC-like drives as well as larger systems for business computers. A sale of part of Digital's drive line could be among the first of a series of properties Digital president Robert Palmer is expected to sell off in an effort to raise cash to help Digital come out of its slump. The sale would be "part of our overall plan to return the company to profitability as quickly as possible," Palmer said.

James Porter, an analyst for Disk/Trend in Mountain View, said that while sale of Digital's drive business could raise cash for the company, it might be a short sighted move since the business is one of the best run at the company.

Flat panel etcher grant to Lam

The US Display Consortium has awarded US$6.7 million to Lam Research of Fremont, to develop a new breed of 'etching' devices crucial in the manufacturing of advanced new flat panel screen displays.

The grant will be matched from Lam's corporate offers, and is designed to produce an etcher that exceeds in quality and cost the models currently used by Japanese companies, which now dominate the flat panel market.

The etchers are expected to cost between US$2 million to $4 million and are similar to those used in the semiconductor manufacturing process. Lam currently is the world leader in selling etching products. It said that in entering the flat panel supplier market, it was hoping to make use of much the same technology.

Consortium chief executive Peter Mills said the grant was designed to advance the group's goal of developing the manufacturing infrastructure necessary for a health domestic flat panel market. In exchange for supplying some of the research funding, Mills said, the consortium will be involved in the design process and be guaranteed that US companies needing the products will be sold them before Lam offers them elsewhere.

Xerox's Palo Alto Research Center, which is expected to receive a major federal grant soon to make prototype of a high resolution flat panel display it has designed, will also be working with Lam.

Formed last year, the consortium is composed of 13 display and computer companies. It has an annual budget of US$20 million from the Pentagon and a smaller amount from its member companies. Because the US government recently announced a major new flat panel initiative, the consortium's budget is expected to grow in coming years.

Apple picks new female director

Apple Computer has announced the appointment of Milwaukee executive Katherine Hudson to its board of directors, making her just the second female director in the company's 17-year history. Apple had been by far the largest Silicon Valley company without a woman on its board. The only other woman to serve on Apple's board was astronaut Sally Ride, who resigned in 1989 after one year.

Hudson is president and chief executive of W.H. Brady Co, an 80 year old publicly held company that makes coated films, specialty adhesives and industrial labels, and labelling systems — including those that put bar codes on disk drives and markings on computer chips. It had revenues of US$243 million in fiscal 1993.

Hudson joins a tiny minority in Silicon Valley. Only 3% of the directors of Silicon Valley companies are women — less than half the national average for large corporations.

National joint venture in China

National Semiconductor has entered into a joint venture agreement with Shanghai Sunrise Electronic Technology to establish a manufacturing facility in China, to be known as National Semiconductor Shanghai Sunrise. The move makes National the latest US semiconductor company to expand aggressively into China. Two months ago, Intel announced a joint venture for the manufacturing of 386 processors in China.

The joint venture fab facility, to be located near Shanghai will specialise in the production of hybrid integrated circuits. Production is expected to commence in the third quarter of calendar 1995. The first product of the new joint venture is called SLIM (Subscriber Line Interface Module), a key component for medium to large size telephone central office systems. SLIM is manufactured in accordance with Chinese specifications and is now used extensively in Chinese designed central office systems.

At present National Semiconductor and Shanghai Sunrise Technology manufacture more than 100,000 SLIM units each month. SLIM has been well received by many Chinese customers, including the Telecommunications and Industry Corp. of China, due to its advanced technology, reliability and practicality. The product has significantly contributed to the localisation of central office system manufacturing in China.

Sculley lands job with Kodak

John Sculley is back in the high tech business — not in the forefront he has been accustomed to at Apple, but as a marketing consultant to Kodak's high tech imaging products division. Just a year ago, Sculley had reportedly been considered a top contender to take over as chief executive officer of Kodak. Instead he went to work for scandal ridden Spectrum Technology.

At Kodak Sculley will advise the photographic products company on marketing its high tech imaging products such as the Photo-CD line.

The appointment came just one day after Kodak announced it would sell its pharmaceutical division so it could focus more attention on the imaging products business. Sculley will spend about 25% of his time working for Kodak.

Sculley was reportedly asked to join Kodak as a consultant by George Fisher, Kodak's new CEO. Fisher and Sculley have a long standing relationship, as Fisher used to head up the Motorola division that produced microprocessors for the Macintosh.

"He (Sculley) is going to immerse himself in our technology and provide teams of Kodak people with advice on developing marketing plans," said Kodak spokesman Paul Allen.

Sculley's image as America's 'hottest' executive and the high tech industry's premier visionary was damaged severely when Apple fired Sculley in June 1993 for spending too much time in Washington and allowing Apple to lose momentum in the vulnerable PC marketplace. The image took an even steeper dive after the fiasco at Spectrum, where he resigned after less than six months on the job and amidst reports that he had been used by Spectrum officials to help prop up the value of their company's stock on Wall Street. ❖

Product Review:

SOUND BLASTER 16 'VALUE EDITION' CARD

A recent addition to the very popular range of sound cards from Creative Labs is the Sound Blaster 16 Value Edition, which offers full 16-bit stereo recording and playback at up to 44.1kHz on machines with 386DX and higher processors. It also provides enhanced FM music synthesis with the OPL3 four-operator chip, a software-adjustable audio mixer, a MIDI port and a pair of inbuilt audio amplifiers.

by JIM ROWE

With the growing emphasis on 'multimedia' PC applications, most people are finding that their IBM-compatible computer nowadays needs a sound card, and ideally a CD-ROM drive as well.

No problem, you may think; just buy a card and a drive/interface kit, take a few minutes to install them, and away you go. Only it isn't that easy, in practice — even where sound cards alone are concerned...

For a start, there's a bewildering array of cards to choose from — ranging from the simplest 8-bit Ad Lib and Sound Blaster compatible models right up to fancy 16-bit or better models with full wavetable synthesis, built in CD-ROM interface and other bells and whistles. Picking the right one for your particular needs can be surprisingly hard.

Then there's the matter of compatibility. From personal experience as well as discussions with other people who have gone through similar exercises, I can testify that adding a sound card to an existing system can have surprising complications. What seems like a straightforward job can turn out to be a veritable nightmare.

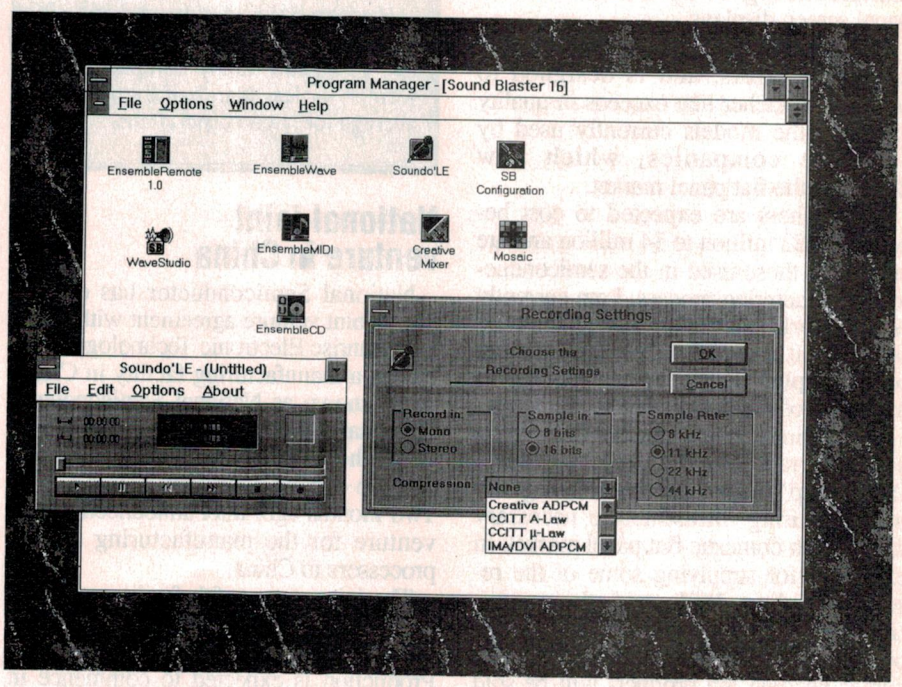
About eight months ago, for example, after successfully fitting a SCSI card and desktop scanner to my system, and then adding a CD-ROM drive as well — again without any problems — I bought one of the fancy high-end sound cards. (I'd better not mention the brand or model, but it had been getting 'rave' reviews.) I then spent a huge amount of time (a) trying to get *all* of its functions working, on my computer, and then (b) trying to track down the causes of mysterious 'crashes' and data corruption errors which began to occur, with frustrating regularity.

Seeking advice from both the card's local distributor and the PC supplier, I tried every remedy they suggested. I tried every different possible combination of card I/O address, IRQ line and DMA channel; I tried varying some of the subtle (and poorly explained) system 'tweaking' parameters in the computer's CMOS memory configuration; and I also tried running all the diagnostic programs I could get hold of, too.

And the nett result? Well, I did get all of the sound card's functions working, finally; but the computer was still plagued with frequent data corruption problems and mysterious crashes, which stubbornly resisted all attempts to find a cure.

So in the end, I took the sound card out again and packed it away in the box. Then I restored the computer to the way it was before, and not surprisingly everything worked fine again — apart from no sound...

Of course the safest way to go is to buy a computer with the sound card and



A screen dump showing Sound Blaster 16's Windows support program Soundo'LE opened ready for use (lower left), and with its recording settings dialog box open. Note the choice of software compression algorithms available.

other enhancements already fitted, because then someone else (either the manufacturer or the dealer) has presumably solved any of these potential compatibility problems for you. But this approach is generally not feasible if you wish to add these items to an existing machine, as many of us do.

Enter the SB16

Needless to say I was therefore rather interested in trying out one of the new 'Value Edition' Sound Blaster 16 kits, when the opportunity came to review one from Dick Smith Electronics. More of what happened this time anon; a bit of background and a few facts and figures first.

The Sound Blaster 16 is a recent addition to the Creative Labs range, which began back in 1989 with the original 8-bit mono Sound Blaster. Although modest in performance by modern standards, this offered a lot of features for a very attractive price, and rapidly 'took off'. Creative soon added other models, and the nett result is that today they've probably delivered more PC sound cards than everyone else put together.

This is reflected in the software, too. Just about all DOS-based software which needs or can take advantage of a sound card will work with the Sound Blaster family, whereas many programs won't produce a peep from some of the fancier cards. The situation is somewhat better with *Windows*-based software, of course; providing the card comes with drivers for *Windows*, there's usually no problem.

As the name suggests, the SB16 card has enhanced dual A/D and D/A converters, capable of performing full 16-bit digital recording and playback of stereo audio signals, at sampling rates of up to 44.1kHz on a computer using a 386DX or better processor. This means it can perform essentially 'CD quality' stereo digitising, with a nominal 90dB dynamic range, for a sampling time determined basically by your computer's free hard disk capacity.

As with the earlier models, it also has an FM-oscillator type music synthesiser. In this case, while still compatible with the earlier Sound Blaster synthesisers (and Adlib voice synthesiser), it is based on the improved Yamaha OPL3 synthesiser chip, which provides up to 20 instrument voices based on two operators, or 11 voices based on four operators.

Other enhancements on the SB16 card include a software-adjusted stereo mixer (32 levels of 2dB for gain, 15 levels of 2dB for bass and treble); an improved MIDI port compatible with the MPU-401 standard as well as the earlier Sound Blasters; the ability to use a 16-bit DMA channel as well as an 8-channel, for faster storage and retrieval of data; and finally provision for adding Creative's Wave Blaster upgrade card, which provides 32-voice wavetable synthesis and full General MIDI compatibility (the basic card only provides a subset of the MIDI standard).

As with many of the earlier models you get two built in 4W (PMPO) audio amps, to drive external speakers, and a proprietary interface for one of Creative's CD-ROM drives. You also get stereo line input and output jacks, a microphone jack, a standard 15-pin joystick/MIDI connector and an internal CD-audio input connector.

In fact, there are only a couple of things that the 'Value Edition' Sound Blaster 16 seems to lack, compared with the top of the line SB16 ASP model. One is the special DSP chip, which performs *hardware* compression and decompression during sound recording and playback; on the Value Edition SB16, these operations are performed by software. Another is that here you don't get a microphone; you need to supply your own. Finally you can't do voice recognition, which is available with the SB16 ASP.

Otherwise, you seem to get just about everything provided with the SB16 ASP. You get a very respectable suite of software, for both DOS and *Windows*, a stereo cable with RCA plugs to connect the card to either an external amplifier or speakers, and a set of concise, but helpful manuals.

What I found...

After my earlier unhappy experiences with another sound card, I was very interested to see how the SB16 card would go — in the same 486DX/33MHz machine as before.

Basically, the SB16 installation went like clockwork, following the instructions in the manual. After the card was fitted, I ran the DIAGNOSE program as directed. This checks for any I/O address, IRQ or DMA channel clashes with other parts of the system — but in this case it reported no problems with the default configuration.

I was then able to proceed with installing both the *Windows* and DOS software, without any hassles, and try it all out.

The result? Everything worked fine. I could record and play back sound files in either 8-bit or 16-bit format, play standard .WAV files from other sources, or play MIDI files through the SB16's FM synthesiser or an external MIDI synthesiser. Not surprisingly I could also use the card's sound resources with a variety of DOS and *Windows*-based software (including the *Spectra Plus* audio analyser package, reviewed last month).

The software utilities that come with the SB16 make it very easy to perform all of the usual functions required with a sound card. In *Windows* you can adjust all of the levels with the Creative Mixer, play audio CD, .WAV or .MID files with the on-screen Ensemble 'players' (also accessible via the Ensemble 'Remote Control' pop-up), play Mosaic, a little audio-visual game, record and edit .WAV files with SB WaveStudio, and perform similar functions — plus 'attaching' sounds to system and applications software functions — using SoundOLE.

You can also run the speech synthesis programs Monologue for Windows or Talking Scheduler, if you choose to install them. Similarly in DOS you can run the FM Intelligent Organ program, SBTALKER (a DOS-based speech synthesiser) or any other SB-compatible software using sound.

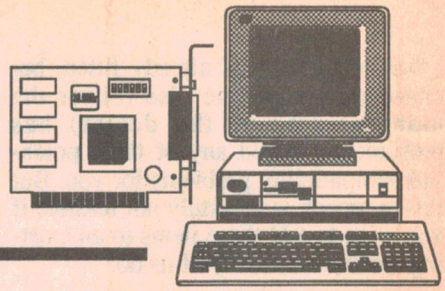
In the six weeks or so since I installed the SB16, it has in fact worked extremely well on just about every score. The basic 20 x 2/11 x 4 FM synthesiser admittedly isn't quite as satisfying as the fancy wavetable synthesiser in the previous card, with some of the instruments sounding a bit anaemic when you're playing more adventurous MIDI files. Presumably this can be fixed if you invest in the Wave Blaster daughter board...

On the other hand, the computer has worked perfectly every since the SB16 was installed — with *not one* of those mysterious crashes or data corruption problems. That being the case, and bearing in mind the low price of the SB16 Value Edition — it's currently only $229 — I'm happy to give it a very high commendation.

If you're after a true 16-bit sound card which is not only compatible with just about all of the software but also 'computer friendly', at a very attractive price, this one is the one to go for. The only thing it lacks, from a practical point of view, is full General MIDI compliance — and you can get this with the Wave Blaser upgrade, if you want it.

My thanks to Dick Smith Electronics for the opportunity to try one out. It's available at any of the DSE outlets, and also through their mail order service. ❖

Computer News and New Products



Smart keyboard for Macintoshes

Australian company AC&P has released an Apple Macintosh compatible 'smart' computer keyboard that includes a 40-character LCD keyboard display and a 15-page text memory storage capacity. Called the AlphaSmart keyboard, it is compatible with all Macintosh hardware and software that can run Apple's System 6.0 or later. The keyboard lets users enter and edit text, then transfer it to a Macintosh computer for formatting and printing.

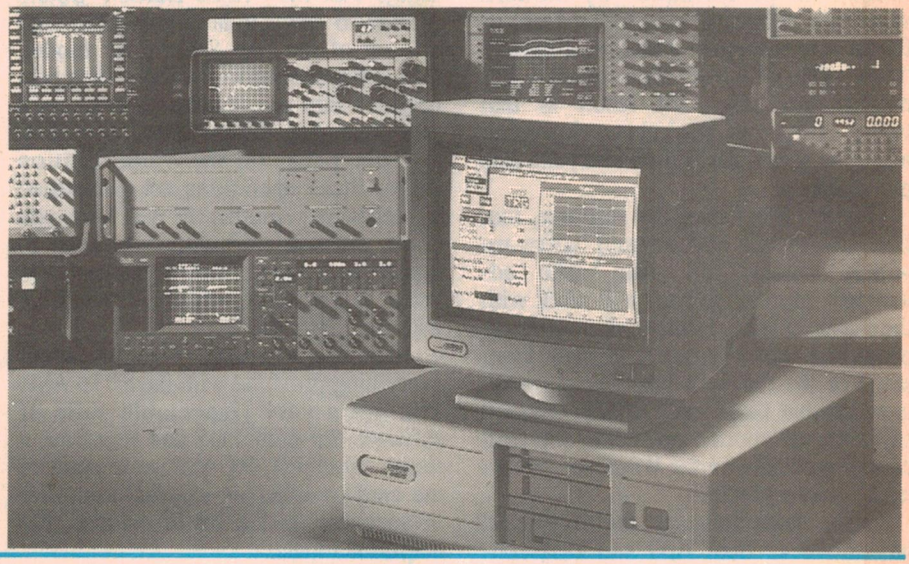
There is no software to install and the keyboard can be taken straight from the box and used immediately. There are eight separate files available in AlphaSmart so that different users can store their own files, without interfering with other work stored in the keyboard.

The keyboard is a low cost way for teachers to get more 'keyboard time' for their students. AlphaSmart is powered by two AA alkaline batteries and an AC adaptor which come with the product, or by an optional re-chargeable NiCad battery pack. Up to 100 hours of battery life ensures continuous operation for even the heaviest sessions. A lithium battery protects the data and your place in the text, even when the unit is turned off. The RRP of the keyboard is $580 (tax included).

For further information circle 166 on the reader service coupon or contact AC&P, Unit 2, 8 Newcastle Road, Bayswater 3153; phone (03) 720 4344.

LabVIEW, LabWindows drivers on CD-ROM

National Instruments has announced that LabVIEW and LabWindows users can now obtain the company's entire library of instrument drivers on a CD-ROM. The single disc contains the LabVIEW and LabWindows drivers for more than 350 GPIB, VXI, serial and CAMAC instruments. It contains instrument drivers for LabVIEW 3.0 for Windows, Sun, and Macintosh; LabWindows/CVI for Windows and Sun; LabVIEW 2.5.2 for Windows and Sun; LabWindows 2.x for DOS; LabVIEW 2.2.1 for Macintosh. The CD-ROM will be updated quarterly to include new instrument driver libraries for current versions of LabVIEW and LabWindows.

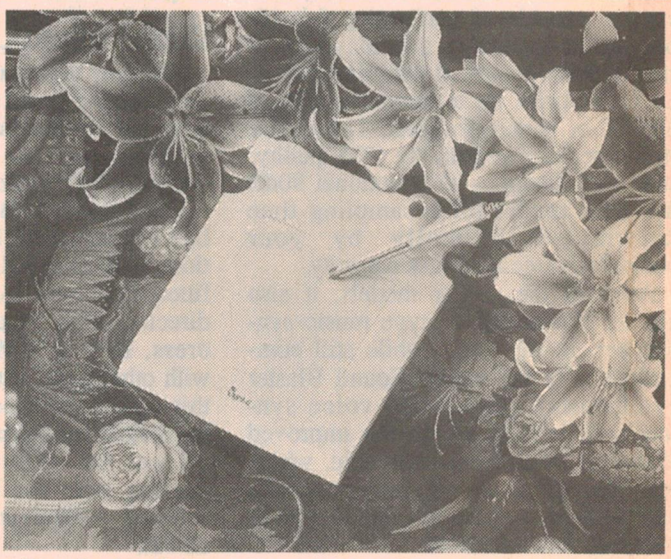


Low cost graphics tablet

Genius Australia has released a low-cost input device that combines the functions of mouse and graphics tablet, making it ideal for painting, tracing pictures and free-hand drawing in both DOS and Windows applications.

The graphics tablet features a drafting area of 127 x 127mm (5" x 5"), and incorporates a LED display so the user is informed of the system's status. The soft-tip, agile pen stylus attaches to either side of the tablet, for left or right-handed users, and features two buttons programmed under Windows, making the pen more functional than a mouse. It also has a higher resolution of 1016LPI (lines per inch) and greater accuracy of 0.01".

The package's minimum requirements are a '386 PC, standard RS-232C serial port, hard disk, standard keyboard adaptor port and VGA monitor. It is available for a limited time at $199. The package includes the EasyPainter drawing pad, two-button stylus pen, keyboard power adaptor and 25-9 pin adaptor, PC Paintbrush for Windows drawing software, user's guide, and utilities software for using other applications including AD driver for AutoCAD, WINAB Windows tablet driver and Genius mouse driver.



For further information circle 163 on the reader service coupon or contact Genius Australia, 4 Briar Street, Fulham Gardens 5024; phone (08) 235 2388.

LabVIEW and LabWindows are general purpose programming tools that have been customised for developing computer-controlled instrumentation systems. Engineers and scientists use these systems to automate applications requiring the measurement, monitoring, or control of real-world parameters such as voltage, temperature, pressure, weight, pH, force, displacement, light intensity, and flow.

For further information circle 169 on the reader service coupon or contact National Instruments Australia, PO Box 466, Ringwood, 3134; phone (03) 879 9422.

Banksia upgrades PCMCIA fax modem

Banksia Technology has announced an upgraded version of its PCM14-4F model. It incorporates a new processor which includes a built-in 16550 UART (universal asynchronous receiver transmitter) which delivers 16 bits in transmit and receive modes.

The new modem can now be used with the IBM PC Support Package for the AS/400, and also supports DCA's RLN (Remote LAN Access) software. The modem offers 14.4kbps raw speed and up to 57.6kbps effective throughput. It features Class 1 and 2 fax compatibility, sending and receiving V.17 faxes at 14.4kbps, to or from suitable fax machines or fax cards. The PCM14-4F complies with PCMCIA Type II standards, which means it is only 5mm thick. Like its predecessor, the new PCM14-4F models costs $799 RRP.

For further information circle 161 on the reader service coupon or contact Banksia Technology, 83 Longueville Road, Lane Cove 2066; phone (02) 418 6033.

PC is credit card sized

DGE Systems have expanded their range of credit card sized embeddable PCs with the addition of the new GCAT-6000 series modules. The GCAT series consists of a range of processor cards and I/O modules that can be put together to make embedded controllers operating in an MSDOS environment. The stackable GCAT modules measure 86 x 65mm, making them one of the smallest PC compatibles in the world. With a power consumption of 45mA at 5V and 50uA in suspend mode, the GCAT-6000 is ideal for battery and solar powered applications.

For further information circle 162 on the reader service coupon or contact

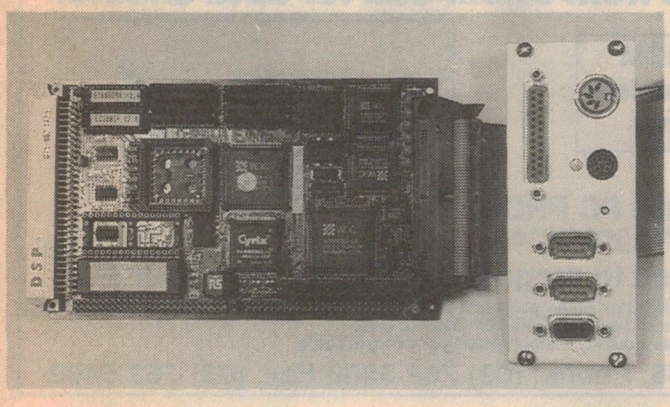
'486 on a Eurocard

DGE Systems has released the EC486 Euro Card computer that incorporates everything needed for embedded applications. It is on a single card measuring 160 x 100mm.

On-board features include 25MHz CX486SLC CPU, 80387SX co-processor socket, up to 4MB DRAM, display driver for CRT, colour LCD, plasma and EL displays, floppy and IDE controllers, COM1, COM2, LPT1, bus mouse, keyboard and sound ports, +5V operation, low power consumption using CMOS technology, 1MB ROMdisk and RAMdisk, expansion via STEbus, ATbus or PCbus.

Because these functions are on the same board as the processor, the speed of the computer is higher than a motherboard with adaptor cards. A completely solid state system is possible by using RAMdisks and ROMdisks.

For further information circle 171 on the reader service coupon or contact DGE Systems, 103 Broadmeadow Road, Broadmeadow 2292; phone (049) 61 3311.



COMPUTER NEWS

DGE Systems, 103 Broadmeadow Road, Broadmeadow 2292; phone (049) 61 3311.

CD-ROM has IC, semiconductor data

Hinton Information Services has announced a range of products and services for sourcing ICs and semiconductors, including a CD-ROM system.

The IC/Discrete Parameter Database on CD-ROM has over 1,500,000 devices and their parameters, 940,000 active devices, 530,000 discontinued devices, 1,900,000 suggested alternatives, 1,200 worldwide manufacturers and 664,000 manufacturers' datasheet pages.

IC/Discrete also includes Australian and overseas distributors, device pinout information and the ability to add in-house part number information. A 12-month subscription to the database includes the IC/Discrete index and 55 CD-ROM image discs containing scanned manufacturers datasheets.

For further information circle 170 on the reader service coupon or call Hinton Information Services, free phone 1800 062 299, free fax 1800 817 716.

9GB A-V drive

Micropolis has released its 9.1 gigabyte 5.25" Scorpio Model 1991 AV disk drive, specifically designed for enhanced digital and audio performance in applications such as multimedia, desktop publishing, digital video editing, and video servers.

The drive has a predetermined audio/video data rate of 4.3MB/s and a maximum sustained transfer rate of 6.4MB/s. The definition of audio/video rating is the guaranteed rate that digital audio/video is delivered without causing frame dropouts and jerkiness in audio/video output.

The Scorpio 1991 AV also features a 500,000 hour mean-time-between-failure (MTBF) and a five year warranty when purchased through an authorised Micropolis reseller or distributor. The RRP of the drive is $7990 (including tax).

For further information circle 168 on the reader service coupon or contact Micropolis Corp, Level 21, 201 Miller Street, North Sydney 2060; phone (02) 959 2326.

DOS Card for Power Macs

Apple has announced a Power Macintosh system running a prototype DOS compatibility card with an i486 DX2/50 microprocessor. When installed in a Macintosh computer, the card will allow users to run thousands of Macintosh, DOS and Windows programs as well as exchange files with DOS and Windows users. DOS and Windows compatibility for the Power Macintosh line of personal computers is currently available through Insignia Solutions' SoftWindows. This card is for users who want to run non-Macintosh applications in native mode, resulting in faster operations regardless of the underlying operating system.

For further information circle 167 on the reader service coupon or contact Apple Computer Australia, 16 Rodborough Road, Frenchs Forest 2086; phone (02) 452 8000.

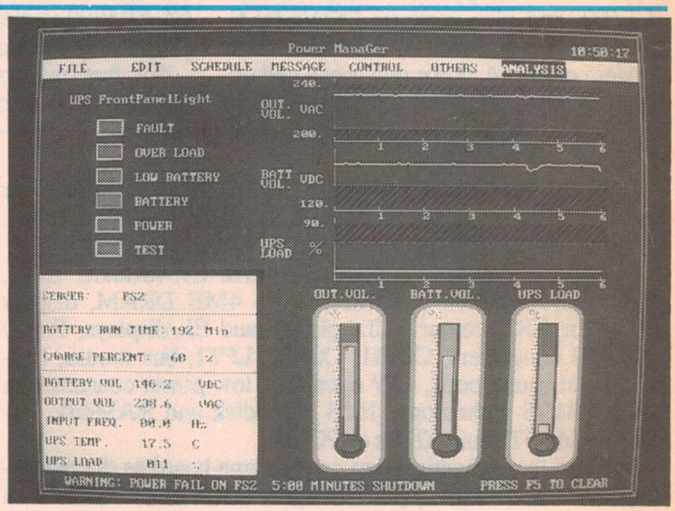
Software monitors UPS operation

Power Manager is a software package designed to interface to the Critec range of UPS (uninterruptable power supply) models via the computer's serial port.

Following a mains failure, the UPS supplies power to keep the hardware operating. At the same time Power Manager receives a message from the UPS that operation is now on battery backup. The software in turn signals all users logged onto the system. After an appropriate time, or upon receiving a signal from the UPS that its batteries are nearing exhaustion, Power Manager flags users that a shutdown is about to commence and automatically initiates a methodical procedure of closing files and logging users off the system.

In addition, Power Manager maintains a complete record in the system error log of messages sent with date/time stamping.

Power Manager also supports Critec's intelligent range of UPS by providing the user with an on-screen power analysis of the mains supply and status information on the UPS. The display includes bar graphs of mains voltage, mains frequency, UPS load, battery status, UPS temperature and time remaining.



For further information circle 165 on the reader service coupon or contact Critec, GPO Box 536, Hobart 7001; phone (002) 73 0066. ❖

At last The Complete Semiconductor Listing – Part 1!

In response to your many requests we are giving a comprehensive listing in the next few ads of the semi's we stock, we suggest you cut this ad out or photocopy for future reference!

74AC SERIES

74AC00PC	Quad 2 Input NAND	$1.00
74AC04PC	Hex Inverter	$0.90
74AC10PC	Triple 3 Input NAND	$0.85
74AC14PC	Hex Schmitt Trigger	$1.35
74AC74PC	Dual D Flip Flop	$1.45
74AC86PC	Quad Exclusive OR	$1.50
74AC138PC	3/8 Decoder	$1.65
74AC174PC	Hex D Flip Flop	$1.65

74ACT SERIES

74ACT04N	Hex Inverter	$0.80
74ACT109PC	Dual J-K Flip Flop	$1.30

74C SERIES

74C04N	See CD4069CN	$0.65
74C08N	Quad 2 Input AND	$0.70
74C10N	Triple 3 Input NAND	$0.80
74C14N	Hex Schmitt Trigger	$0.75
74C20N	Dual 4 Input NAND	$0.70
74C32N	Quad 2 Input OR	$0.85
74C42N	BCD/Dec Decoder	$2.00
74C74N	Dual D Flip Flop	$1.00
74C76N	Dual J-K Flip Flop	$1.90
74C86N	Quad Exclusive OR	$0.90
74C95N	4 Bit Shift Register	$2.80
74C150N	1 of 16 Decoder	$7.10
74C160N	Preset Decade Cntr	$2.15
74C161N	Preset Binary Cntr	$1.50
74C162N	Preset Decade Cntr	$2.05
74C163N	Preset Binary Cntr	$1.65
74C173N	Tri-State Qd Latch	$1.15
74C174N	Hex D Flip Flop	$1.15
74C175N	Quad D Flip Flop	$1.00
74C193N	Up/Dn Binary Cntr	$1.55
74C195N	4 Bit Parallel S/R	$2.35
74C240N	Tri-State Octal Bufr	$3.55
74C244N	Tri-State Octal Bufr	$3.80
74C373N	Tri-State Octal Ltch	$2.90
74C374N	Tri-State Octal D F/	$3.25
74C902N	Hex Buffer	$1.40
74C903N	Hex Invert Buffer	$1.05
74C904N	Hex Buffer	$1.35
74C906N	Hex Open Dr Buffer	$2.75
74C909N	CMOS Quad Comp	$5.05
74C911N	Display Controller	$28.60
74C917N	Display Controller	$28.60
74C922N	16 Key Encoder	$10.00
74C923N	20 Key Encoder	$10.95
74C927N	4 Digit Counter	$11.70
74C928N	4 Digit Counter	$14.25
74C941N	Tri-State Octal Bufr	$3.95

74HC SERIES

74HC00N	Quad 2 Input NAND	$0.85
74HC02N	Quad 2 Input NOR	$0.85
74HC03N	Quad 2 Input NAND	$0.85
74HC04N	Hex Inverter	$0.85
74HCU04N	Hex Inverter	$0.60
74HC08N	Quad 2 Input AND	$0.95
74HC10N	Triple 3 Input NAND	$0.85
74HC11N	Triple 3 Input AND	$1.25
74HC14N	Hex Schmitt Trigger	$0.95
74HC20N	Dual 4 Input NAND	$0.85
74HC27N	Triple 3 Input NOR	$0.85
74HC30N	8 Input NAND	$0.85
74HC32N	Quad 2 Input OR	$0.85
74HC42N	BCD-Dec Decoder	$1.90
74HC74AN	Dual D Flip Flop	$2.10
74HC75N	Quad D Flip Flop	$1.35
74HC76N	Dual J-K Flip Flop	$1.50
74HC85N	4 Bit Comparator	$1.95
74HC86N	Quad Exclusive OR	$1.05
74HC107N	Dual J-K Flip Flop	$1.30
74HC112N	Dual J-K Flip Flop	$1.30
74HC123AN	Dual Monostable	$2.45
74HC125N	Tri-State Buffer	$1.20
74HC126N	Tri-State Buffer	$1.30
74HC132N	Quad 2 In Schmitt	$2.55
74HC133N	13 Input NAND	$1.60
74HC138N	3/8 Decoder	$1.00
74HC139N	Dual 2/4 Decoder	$1.00
74HC147N	10/4 Encoder	$2.00
74HC151N	8/1 Mux	$1.50
74HC153N	Dual 4/1 Mux	$1.15
74HC154N	4/16 Decoder	$2.70
74HC157N	Quad 2 Input Mux	$2.55
74HC160N	Preset Dec Ctr	$1.90
74HC161N	Preset Binary Ctr	$1.35
74HC162N	Decade Counter	$1.35
74HC163N	Binary Counter	$1.35
74HC164N	8 Bit SI PO S/R	$1.35
74HC165N	8 Bit PI SO S/R	$1.45
74HC166N	8 Bit P.I.P.O. Rgstr	$1.35
74HC173N	Quad D Flip Flop	$1.35
74HC174N	Hex D Flip Flop	$1.30
74HC175N	Qd D F/F W/- Clear	$1.30
74HC190N	Up/Down Counter	$1.45
74HC192N	Up/Down Decade	$1.70
74HC193N	Up/Down Binary	$1.60
74HC194N	Shift Register	$1.40
74HC195N	Shift Register	$1.60
74HC221AN	Dual Monostable	$2.30
74HC237N	3 to 8 Dcoder/Latch	$1.35
74HC240N	Octal Buffer	$1.75
74HC241N	Octal Buffer	$1.60
74HC242N	Tri-State Tcvr	$1.85
74HC244N	Octal Buffer	$1.50
74HC245AN	Tri-State Oct Tcvr	$1.60
74HC251N	Tri-State 2/1 Mux	$1.40
74HC253N	Dual 4/1 Mux	$1.40
74HC257N	Quad 2 Input Mux	$1.15
74HC266N	Qu 2 In XNOR Gate	$1.65
74HC273N	Octal D Flip Flop	$2.40
74HC299N	Tri-State 8 Bit S/R	$4.80
74HC354N	Latched Mux	$3.20
74HC356N	Tri-State Hex Buffer	$3.20
74HC373N	Octal D Latch	$1.60
74HC374N	Octal D Flip Flop	$1.60
74HC390N	Dual Dec Counter	$1.45
74HC393N	Dual Binary Counter	$1.95
74HC521N	See 74HC688N	
74HC533N	Octal D Latch	$3.15
74HC534N	Octal D Flip Flop	$3.15
74HC540N	Tri-State Oct Buffer	$2.90
74HC541N	Tri-State Oct Buffer	$2.35
74HC573N	Tri-State Oct Driver	$2.50
74HC574N	Tri-State Oct Driver	$1.90
74HC640N	Tri-State Octal Tcvr	$3.40
74HC643N	Tri-State Octal Tcvr	$3.40
74HC688N	8 Bit Comparator	$2.25
74HC4002N	Dual 4 Input NOR	$1.15
74HC4016N	Qu Analog Switch	$1.80
74HC4017N	Decade Ctr/Divide	$2.30
74HC4020N	Binary Counter	$2.05
74HC4024N	7 Stage Ripple Ctr	$1.95
74HC4040N	Binary Counter	$1.60
74HC4046N	Phase Lock Loop	$2.20
74HC4051N	8 Ch Analog Mux	$2.05
74HC4052N	Dual 4 Chl Mux	$2.50
74HC4060N	Binary Counter	$1.45
74HC4066N	Qu Bilateral Sw	$1.45
74HC4075N	Triple Input OR	$1.00
74HC4078N	8 Input NOR	$0.90
74HC4316N	Qu Analogue Sw	$2.80
74HC4538N	Dual Monostable	$1.95

74HCT SERIES

74HCT00N	Quad 2 Input NAND	$0.95
74HCT03N	Quad 2 Input NAND	$1.15
74HCT04N	Hex Inverter	$0.95
74HCT08N	Quad 2 Input AND	$0.95
74HCT11N	Triple 3 Input AND	$1.15
74HCT14N	Hex Schmitt Trigger	$0.75
74HCT20N	Dual 4 Input NAND	$0.45
74HCT21N	Dual 4 Input AND	$0.45
74HCT27N	Triple 3 NOR	$0.45
74HCT30N	8 Input NAND	$0.55
74HCT32N	Quad 2 Input OR	$0.55
74HCT42N	BCD-Dec Decoder	$0.90
74HCT73N	Dual J-K Flip Flop	$0.65
74HCT74N	Dual D Flip Flop	$2.10
74HCT75N	Quad D Flip Flop	$1.00
74HCT85N	4 Bit Comparator	$1.25
74HCT86N	Quad Exclusive OR	$1.00
74HCT93N	Binary Counter	$1.45
74HCT123N	Dual Monostable	$1.70
74HCT125N	Tri-State Buffer	$1.70
74HCT126N	Tri-State Buffer	$1.50
74HCT132N	Quad 2 Inp Schm	$1.40
74HCT138N	3/8 Decoder	$1.15
74HCT139N	Dual 2/4 Decoder	$0.90
74HCT174N	Hex D Flip Flop	$0.90
74HCT191N	Up/Dn Dec Cnter	$1.35
74HCT240N	LS Cmp Oct Bufr	$5.05
74HCT244N	Tri-State Octal Dvr	$1.05
74HCT245N	Tri-State Oct Tcvr	$1.15
74HCT273N	Octal D Flip Flop	$1.70
74HCT373N	Tri-St Octal Latch	$1.15
74HCT374N	Tri-St Oct Latch	$1.15
74HCT390N	Dual Dec Counter	$1.70
74HCT393N	Dual Bin Counter	$1.75
74HCT423AN	Dual Monostable	$1.50
74HCT540N	Tri-State Oct Bffer	$1.95
74HCT541N	Octal Buffer	$1.95
74HCT573N	Tri-State Oct Dver	$1.90
74HCT4316N	Quad An Switch	$1.60

74 SERIES

7400N	Quad 2 Input NAND	$0.80
7403N	Quad 2 Input O.C.	$0.80
7406N	Hex Inverter 30V	$1.00
7407N	Hex Inverter 30V	$1.20
7409N	Quad 2 In AND OC	$0.85
7410N	Triple 3 Input NAND	$0.80
7416N	Offer 7406N	$0.85
7420N	Dual 4 Input NAND	$0.80
7423N	Dual 4 Input NAND	$0.90
7425N	Dual 4 Input NOR	$0.85
7430N	8 Input NAND	$0.80
7437N	Qua 2 In NAND Bufr	$0.90
7442N	BCD/Dec Decoder	$1.10
7446AN	BCD/7 Seg Driver	$2.00
7447N	See 7446AN	$2.00
7453N	AND/OR/INVERT	$1.00
7474N	Dual D Flip Flop	$0.95
7476N	Du J-K Preset/Clear	$1.00
7486N	Quad Exclusive OR	$1.00
7490AN	Decade Counter	$1.00
7493AN	Binary Counter	$1.15
74121N		$3.45
74125N	Tri-State Buffer	$1.30
74150N	16/1 Mux	$3.25
74154N	4/16 Decoder	$3.05
74155N	Dual 2/4 Demux	$1.20
74157N	Quad 2/1 Mux	$1.20
74161N	Synch 4 Bit Bin Ctr	$1.60
74162AN	Preset Decade Ctr	$1.60
74165N	8 Bit Shift Rgstr	$1.45
74174N	Hex D Flip Flop	$1.45
74180N	Parity Generator	$3.10
74184N	BCD/Binary Conv	$5.80
74190N	4 Bit BCD Counter	$1.70
74199N	8 Bit Univ Counter	$3.00
74251N	Data Selector	$2.00
74365N	Tri-State Hex Buffer	$1.15
74366N	Hex Tri-State Buffer	$1.35
74367AN	Tri-State Hex Buffer	$1.25
74368N	Tri-State Hex Buffer	$1.30
DM8601N	Retrig Monostable	$1.35
DM8602N	Dual Monostable	$3.20
DM8123N	Tri-State 2/1 Mux	$2.95
DM8312N		$2.65
DM8334N	8 Bit Addr Latch	$7.15

74ALS SERIES

74ALS00AN	Quad 2 In NAND	$0.90
74ALS01N	Quad 2 In NAND OC	$0.70
74ALS04BN	Hex Buffer	$0.90
74ALS08N	Quad 2 Input AND	$1.00
74ALS12AN	Triple 3 Inp NAND	$1.05
74ALS14N	Hex Schmitt Trigger	$0.70
74ALS15AN	Triple 3 Inp AND	$0.75
74ALS21AN	Dual 4 Input AND	$0.70
74ALS22BN	D 4 Inp NAND OC	$0.75
74ALS28AN	Q 2 In NOR Bufr	$0.95
74ALS33AN	Q 2 Input NOR Bfr	$0.95
74ALS37AN	Q 2 Inp NAND Bfr	$0.95
74ALS40AN	Dual 4 Inp Buffer	$0.95
74ALS74AN	Dual D Flip Flop	$1.05
74ALS109AN	Dual JK Flip Flop	$0.90
74ALS131N	3/8 Dec W/Latch	$1.10
74ALS138N	3/8 Dec-Demux	$1.45
74ALS162BN	Decade Counter	$1.65
74ALS169BN	Up/Down Cnter	$1.55
74ALS257N	Tri-St Qu 2/1 Mux	$1.70
74ALS374N	Tri-State Oct Latch	$3.35
74ALS533N	Invert Octal Ltch	$5.00
74ALS534N	Invert Octal Ltch	$4.35
74ALS1000AN	Buffer 74ALS00	$0.95
74ALS1002AN	Buffer 74ALS02	$1.25
74ALS1003AN	Buffer 74ALS03	$1.25
74ALS1008AN	Buffer 74ALS08	$1.25
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to be continued!

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RJ45 Extension Lead

Modular plug to modular plug with 8 gold contacts and 8 positions wired through. Austel approved. Available in two lengths

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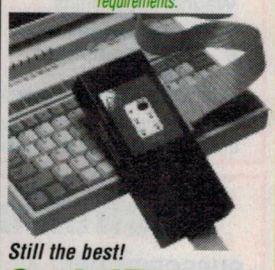
RJ45 Double Adaptor

Allows two telephones or a fax and a phone or a modem to use the one outlet. 8 positions wired through. Austel approved. **$8.25**

Call us for all your telephone cable, accessory and istallation tool requirements.



Still the best!

SerialTest

PC-based Protocol Analyser & Data Line Monitor

The latest version of Serialtest turns ANY PC into a full-featured serial data protocol analyzer — even laptop and notebook computers – for both synchronous and async data. Serialtest unleashes the power of your PC for data communications testing with a simple, user-friendly interface! The new ComProbe plugs in to your printer port. With Serialtest and your PC, there is no longer any need to buy or rent expensive, dedicated protocol analyzers.

The Serialtest package includes Serialtest software and Frontline's RS-232 ComProbe™ adapter. The ComProbe connects to your computer via the parallel printer port *(no need for plug-in cards)* and allows Serialtest to work with both synchronous and asynchronous devices.

Serialtest's monitor mode shows you exactly what information is flowing between any two serial devices — both data bytes and control signals. Source mode allows you to interactively simulate either the DTE or DCE side of the communications link.

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Field service engineers and system integrators will appreciate the portability and ease-of-use. Communication specialists and network supervisors will enjoy the power and flexibility. No matter what the industry, Serialtest will prove to be indispensable.

SerialTest Sync/Async with Comprobe **$2653.60** (ex tax) **$2713.50** (inc tax). *Allow $15 P&P.* Plug Pack **$24.95**.

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READER INFO NO. 42

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Which of our many advertisers are most likely to be able to sell you that special component, instrument, kit or tool? It's not always easy to decide, because they can't advertise all of their product lines each month. Also some are wholesalers and don't sell to the public. The table below is published as a special service to EA readers, as a guide to the main products sold by our retail advertisers. For address information see the advertisements in this or other recent issues.

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KEY TO CODING:
A Kits and modules
B Tools
C PC boards and supplies
D Components
E IC chips and semiconductors
F Test and measuring instruments
G Reference books

Note that the above list is based on our understanding of the products sold by the firms concerned. If there are any errors or omissions, please let us know.

Electronics Australia Reader Services

SUBSCRIPTIONS: All subscription enquiries should be directed to: Subscriptions Department, Federal Publishing Co, PO Box 199, Alexandria 2015; phone (02) 353 9992.
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PROJECT QUERIES: Advice on projects is limited to postal correspondence only and to projects less than five years old. Price $7.50. Please note that we cannot undertake special research or advise on project modifications.
Members of our technical staff are not available to discuss technical problems by telephone.
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PAYMENT: Must be negotiable in Australia and payable to 'Electronics Australia'. Send cheque, money order or credit card number (American Express, Bankcard, Mastercard or Visa card), name and address (see form).
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All **TECS** computer systems are assembled in-house by our own technicians using high quality, brand new parts. This enables us to maintain the top level of standard that our customers demand.

Our systems are proving their reliability and ruggedness in some of the finest institutions such as the Physics department at Victoria University, Dept. of Biochemistry at the University of Tasmania, Dept. of Elect. & Comp. Syst. Eng. at Monash University, and many others.

486SX-33 @$1470	***486DX-40 @$1635***
486DX2-50 @$1695	***486DX2-66 @$1750***

Configuration: 4M RAM, 210M HDD, 1.44M FDD, 1M SVGA card, 2S/1P/1G ports, 101 keyboard, 14" SVGA monitor, in your choice of desk-top or mini-tower case. (add $75 for MS-DOS 6.2)

This month only!! VL-bus IDE I/O, VL-bus SVGA card, 14" non-int. monitor at NO EXTRA COST!

2 Year parts and 5 Year labour warranty

486DX2-66 MULTIMEDIA SYSTEM

If you're looking for a multimedia system, then look no further. Don't be fooled by others which offer you less. This machine is ***40~50% faster*** than a comparable system using 486DX-33 CPU. Graphics based software requires a fast processor to cope with the vast amount of information that each picture holds.

The double speed CD-ROM drive and the **Sound Blaster 16 TRUE STEREO** sound card assures you that you will be able to run the latest software with total compatibility & reliability.

Configuration: 8M RAM, 420M HDD, 1.44M FDD, P24T upgradeable motherboard, 256K cache RAM, VL-bus I/O, VL-bus 1M VGA card, 14" N.I. SVGA monitor (.28mm DP), Panasonic double speed CD-ROM drive, Sound Blaster 16 sound card, pair of amplified speakers, joystick, genuine Microsoft Ergonomic mouse, Honeywell 101 keyboard, MS-DOS 6.2, Windows 3.11, Works for Windows CD, & **Comptons Multimedia Encyclopaedia CD**.

2 Year parts & 5 Year Labour Warranty

$2850

MOTHERBOARDS

Prices of 486 boards are starting to come down to a realistic level. Check out the new ***low prices.***

All boards feature 256K of fast cache RAM fitted, and three VESA local bus slots.

486SX-33	***$285***
486DX-33	***$399***
486DX-40	***$425***
486DX2-50	***$520***
486DX2-66	***$575***

Full 12 month Warranty

Western Digital hard disc drives

210M	***$325***
270M	***$375***
340M	***$425***
420M	***$475***
540M	***$585***

Full 3 year manufacturer's warranty!

Sound card & CD-ROM drive Combo Deal

You can buy individually
Sound Blaster 16 VE for **$230**
Panasonic 562B for **$275**
or
buy the two together for
$450
SAVE $55!!!!

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14 pin (pk.50)	$7.00	28 pin (pk.50)	$14.00
16 pin (pk.50)	$8.00	40 pin (pk.50)	$20.00

SIM MODULES

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4M 70nS	***$255***

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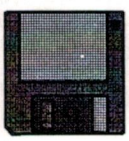

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- PROTECT YOUR VALUABLE COMPUTER.
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$500.00 PLUS ..... FREE	

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N.B. DOES NOT APPLY TO COMPUTER SYSTEMS. ONLY SMALL ITEMS WILL BE SENT BY POST.

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Send your business card to receive our TRADE pricelist on disk free of charge.

Please specify:
3.5" 1.44M or 5.25" 1.2M
Available in MS-DOS format only.

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VL-bus IDE I/O card with
2 x 16550AF
compatible serial ports
Normally $100
Introductory price of ***$69***

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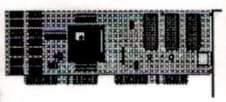
-WHETHER YOU'RE REPLACING A FAULTY CARD OR INSTALLING AN ADDITIONAL CARD, WE CAN OFFER YOU THE RIGHT CHOICE.
-COMPARE OUR PRICES WITH OTHER DEALERS'. YOU'LL FIND OUR PRICES TO BE VERY COMPETITIVE.



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IDE I/O CONTROLLER	**$39.00**
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1 YEAR WARRANTY!!

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Three Firsts for Yokogawa!

First handheld DMM with a safety shutter!

True RMS Reading for Vac & Aac, up to 100kHz

- *Super multi-functions include Temperature, Relative, Frequency, dBm, Data Hold, MIN/MAX Hold, Average and Auto Power Off*
- *Automatic alternate display every 3 seconds of Vac and Hz for convenience*
- *Unique shutter mechanism prevents mis-connection of test leads – Leads can only be connected for current measurement when meter is switched to current ranges*
- *Rugged case and circuitry designed to withstand industrial conditions*
- *ADP mode for use with optional plug-in Adaptors covering Temperature, AC/DC Current, Capacitance and Transistor h_{FE}/ I_{Dss} measurements*

Brief Specifications

Safety:	Based on IEC 348 class II
Display	49999 count LCD
Vdc :	500mV to 1000V (0.07%)
Vac (trms) :	500mV to 750V (0.7%)
Adc :	500µA to 10A (0.3%)
Aac (trms) :	500µA to 10A (1.0%)
Ohms :	500Ω to 50MΩ (0.2%)
Frequency :	10Hz to 999.9kHz (0.05%)
Temperature :	-50.0 to 150.0°C (option)

7544 Series

First AC/DC digital clamp meter with 4000 count display and bargraph!

- *High speed auto-ranging or manual ranging*
- *High speed sampling for 40 segment bar graph display*
- *Average, Temperature test, Max hold, Peak hold functions*
- *Sleep mode to reduce battery consumption*
- *Continuity beeper, Data hold, Diode test and analog signal output functions*
- *Battery or AC adaptor operation*

Brief Specifications

Functions :	AC current, DC current, AC voltage, DC voltage, Resistance, Continuity check, Diode test, Frequency, Temperature, Data hold, Peak hold, Max hold, Average, Sleep mode, Analog signal output
Display :	LCD 3.5 digits, max. reading of 4000 (Hz: 9999) and annunciators
Bar Graph Display :	40 segments
Ranges :	Auto or manual ranging
Aac, Adc :	400, 1000A
Vac, Vdc :	40, 400, 650V
Ohms/Continuity :	400Ω, 4kΩ
Diode Test :	2V
Frequency :	10.0-99.99Hz, 100.0-999.9Hz
Temperature :	-50.0 to +150°C (with optional probe)
Jaw Opening Capability:	55 mm ø or 65 x 18 mm busbar
Withstanding Voltage:	2.5kVac, 1 minute

2343 Series

First pocket DMM with 3200 count display and bargraph!

- *Ultra compact size for one-hand operation*
- *Data Hold function*
- *High speed auto-ranging*
- *High speed sampling: approx. 12 times/ sec. for 32 segment bargraph display*
- *Auto Power Off – doubles battery life*

Brief Specifications

Digital Display :	3.5 digit LCD reading of approx. 3200 and annunciators
Bar graph display :	32 segments
Ranges :	Auto ranging
Vdc :	300mV, 3, 30, 300, 450V
Vac :	3, 30, 300, 450V
Ohms :	300Ω, 3, 30, 300kΩ, 3, 30MΩ
Auto Power Off	The meter is powered off 10 minutes after last operation

7536

Yokogawa Instrument Corporation

Lloyd's Register Quality Assurance to ISO-9001

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READER INFO NO. 4

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